ELECTRICAL REVIEW

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VIEWS, NEWS AND INTERVIEWS

One of the best known engine-builders in the United States has maintained for years a special carriage drawn by a horse to transport him from his residence to his shops. Not long ago his man drove him and a friend down a street which was being paved. A large steam roller was standing on one side, and just as the carriage drove by the safety valve of the roller blew off and scared the horse, who jerked himself free from the harness and ran, leaving the occupants of the carriage at a standstill. The engine-builder, who is known for his coolness in emergencies, arose and remarked, with his eye on the fleeing horse, "D——n a horse anyway! Fred, when you get back to New York, send me all the automobile catalogues you can get."

Lord Rosebery has been elected rector of Glasgow University by 829 votes to 515 votes cast for Lord Kelvin.

The official gazette of the United States Patent Office is a highly interesting document, but rarely contains any sensational or freak contributions. The issue of November 7 broke away from the established traditions of the journal by printing the claims of a patent on a voting machine, granted to James H. Dean, on that date, which occupied 14¼ pages. The patent has 359 claims, which alone embrace over 33,000 words.

There are 268 students enrolled in the engineering department of the University of Michigan for the current year. It is expected that the total enrollment will be 3,000.

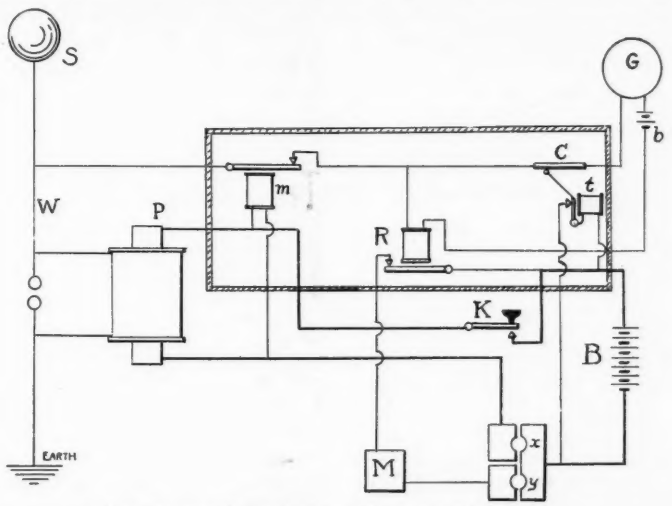
The selectmen of Berlin, Ct., are trying to stop an electric railway company in their vicinity from running a trolley car, known as the "jag car" from New Britain to Berlin. It seems that Berlin is a prohibition town, while New Britain is not. Therefore, the sportively inclined residents of Berlin go to New Britain for spirituous refreshment. As they have to get home, the electric railway company has very kindly provided the "jag car" for their accommodation. It would seem that the railway company is to be commended instead of criticised. The "jags" are provided with a car of their own, they disturb no one, and this is certainly better than having them strung along the highway between the two towns, as would be the case if they had to walk home.

One afternoon recently, the boiler in the electric light station at Ludington, Mich., blew up. The building was wrecked and debris was scattered for blocks around. The boiler rose into the air to a height of thirty feet and then took lodgment in the kitchen of a house half a block distant. The woman of the house had just stepped from the kitchen into the next room when the boiler came crashing through the roof, crushing it like an eggshell.

Mr. Calvin W. Rice, electrician for the New York Consolidated Telegraph and Electrical Subway Company and the New York Gas and Electric Light, Heat and Power Company, will visit Purdue University, and lecture on November 15 before the students of electrical engineering on "The Development of High-Tension Service." While in Lafayette, Ind., Mr. Rice will be entertained by Professor W. E. Goldsborough at his home.

A Wireless Telegraph Repeater.

M. Emile Guarini-Foresio has invented an instrument for repeating wireless telegraph signals which combines, within itself, also means for sending or receiving such signals in the ordinary way. The idea of the apparatus is to receive the feeble signals coming from a distant point, and, at once, to repeat them with added energy to a second point, the function of the apparatus being in this way exactly similar to that of the ordinary telegraph repeater. The diagram



THE GUARINI REPEATER FOR WIRELESS TELEGRAPHY.

shows the apparatus schematically. The usual vertical wire W, having at the top a sphere or other considerable electrical capacity S, has in it a spark gap connected to the secondary of an induction coil. In the primary circuit of this coil is included the battery B, the sending key K, and a three-way plug switch shown in the lower part of the illustration at x y. Shunted around this circuit is the electro-magnet m which operates, whenever the key is depressed or the primary circuit otherwise closed, to open the circuit containing the coherer C. In the derived circuit with the coherer C is the local battery b, the galvanometer G intended to show the condition of the battery and the relay R. The tapper t, which constantly taps the coherer, is shunted around the main battery B. At M is represented the usual Morse registering receiver. To use the apparatus as a sender, the hole x of the plug switch is closed with a conducting plug. Upon manipulating the key the primary circuit of the induction coil is closed, and at the same time the coherer circuit is opened by the small magnet m. The apparatus then works in the usual way as a sender. When it is to work as a receiver the plug is shifted to the hole y. Signals then coming in pass through the coherer C, which becomes conducting, thus actuating the relay R and working the Morse instrument M from the main battery B. When the instrument is to be used as a repeater both holes are plugged and the relay not only closes the circuit of the Morse instrument but also closes the primary of the coil, thus sending out again at once the signal it has received. The more delicate parts of the apparatus, including the coherer, which would be affected by the spark gap, are enclosed in a soft iron box, as shown in the diagram. The ELECTRICAL REVIEW has received a description of the apparatus from which the above is condensed, but has not received any account of its practical operation. The idea is certainly highly ingenious, but, in the absence of some directing means for signals, it looks as if two of these apparatus within each other's range would get into a state of automatic vibration, in the same way that a telephone receiver sometimes does when placed against the mouth of its transmitter.

The Philadelphia Councils' Committee on Law has taken up the ordinance to impose a tax or license upon automobiles. City Solicitor Kinsey has been asked to draft an ordinance in accordance with views he had previously expressed, to the effect that Councils had no right to tax automobiles or to exact a license, except upon those used as hackney coaches. Mr. Kinsey suggested that the best way to cover this point would be to amend the hackney coach ordinance so as to include automobiles, and the committee agreed to recommend such an amendment.

Electric Locomotives vs. Distributed Motors.

One of our British contemporaries, the *Electrical Engineer*, has been giving prizes for the best answers to engineering questions. A recent question and its answer are subjoined:

Question: Compare the advantages and disadvantages of using electric locomotives to drag trains of trailer cars and using trains in which each vehicle is self-propelling.

Answer: The consideration of this question devolves mainly on the relative efficiencies of conversion of the power of the motors into tractive force on the rails in the two cases, for the efficiency of the rest of the system may be the same in both cases. The tractive force transmitted to the rails depends, for a given condition of the rails, on the proportion of the weight of the train on the driving wheels. If there is very little weight on the latter they will "skid," and the train will not move, and it is therefore evident that the greatest grip of the rails will be obtained when the greatest possible weight, or, in other words, the whole weight of the train is on the driving wheels, and the greatest efficiency of conversion will be obtained in this case.

Now, comparing the efficiency of a train, consisting of a locomotive with trailers, or "carriages," with an ordinary electric tramcar, it is evident that, in the first case, the proportion of weight on the driving-wheels is equal to the proportion of the weight of the locomotive to the whole weight of the train (including locomotive), probably one-third of the whole weight, or less, whilst, in the latter case, the whole weight is on the driving-wheels, this comparison being made under the supposition that all the wheels of the locomotive and of the tramcar are driving-wheels. The efficiency of conversion in the case of the tramcar is thus much greater than in the case of the locomotive and trailers. Now, supposing a train is made up of a number of these cars, each having sufficient motor power to propel itself at the desired speed, the efficiency of such a train will be exactly the same as that of one car, however many cars there may be in the train, and each car will take sufficient current to drive itself and its own load at the required speed. Such a train will, therefore, be much more efficient than one consisting of a locomotive with trailer cars; that is to say, that for trains of the same weight to attain and maintain the same speed, less power will be taken from the mains by the train of self-propelling cars than by the locomotive-drawn train; or, for the same power, greater acceleration and maximum speed, and, therefore, very much greater average speed, can be obtained—a point of the utmost importance in the case of railways whose traffic is of the "local" description, with trains following each other in quick succession, such as the Metropolitan and District railways of underground London. In the case of a locomotive with trailers the efficiency decreases as the number of trailers and of passengers increases, not, however, in exact proportion to the weight of extra cars and passengers, as the efficiency of the motors on the locomotive vary with different loads, the maximum efficiency generally being arranged for average load. This, as far as the variation of motor load due to passengers is concerned, also applies in the other case to the car motors, but here the proportion of weight on the drivers always remains constant, so that the efficiency is very little altered by variations of the number of passengers, and not at all by the addition of extra cars, as already stated. Another point is that for a given seating capacity a train of self-propelling cars will be lighter, if carefully designed, than a locomotive-drawn train, assuming, of course, that in both cases the motor power is sufficient to deal with the train when every seat is occupied. This is in spite of the fact that there are a greater number of motors in the former case, and is accounted for by the fact that there is the great dead-weight of the locomotive in the latter case (necessary to obtain the required grip of the rails) in addition to the weight of trailers and passengers, and by the fact that the weight of a motor is roughly proportional to its power for a given pressure, as the total power of the motors in a train of self-propelling cars is less than in a locomotive train, owing to the greater efficiency of the former system, the total weight of all the motors in this system should be less than the weight of the two or three large motors in the other. The total difference in the weights of the two trains would therefore be, roughly, the weight of the locomotive without its motors, plus the extra weight of motors in the locomotive system. For this reason of weight, therefore, a locomotive train will require more power for propulsion than a train of self-propelling cars containing the same number of passengers. The question of weight also considerably influences the cost of building the track, as, owing to the fact that the weight of the train is evenly distributed over a large area, and that the weight per driver is less in the train of self-propelling cars than in the locomotive-drawn train, the rails and sleepers may be lighter (provided the former are of sufficient carrying capacity in a rail-return system), and bridges and viaducts need not be so substantially built. In addition to this, a train of the former kind can go up steeper hills, with the same amount of power, than a locomotive train, owing to the better grip of the rails already mentioned, and hence cuttings need not be so deep or viaducts and banks so high in undulating country. There is also less wear on the rails, owing to the comparative absence of skidding. As regards the cost of building and equipping the moving stock, probably the locomotive system would be rather cheaper, but not a great deal, and this extra primary cost would be more than compensated for in the other system by the smaller cost of the track and greater economy of working.

Although not strictly within the scope of the question, it will be as well before proceeding further, owing to the little that is known of the system in England, to explain how the motors on each car may be controlled in a train of self-propelling cars. To begin with, in order to reap the greatest advantage from the system, each car should be fitted with a controller at each end, so that if necessary—for shunting purposes, for instance—it can be operated alone and in either direction, and also in order that it shall make no difference which car has the place of honor at the head of the train or which way round that car happens to be on the rails. As it would, for obvious reasons, be impracticable to have an operator on each car to control the motors on that particular car when the cars are made up into a train, some system must be used for controlling all the motors from one point on the train. This might be done by picking up the main current on the first car and passing it through feeders to all the other cars, but in this case all the cars would have to be fitted with cables and contact shoes large enough to supply current to all the motors on the longest train likely to be used, as a particular car would not always be in the same part of a train. Such an arrangement would be clumsy and impracticable, not to mention expensive. The plan adopted on the South Side Elevated Railway at Chicago, where this system has been adpated to the designs of Mr. F. J. Sprague, the originator of the system, is as follows: The cars are all fitted with two sets of controllers, the master controllers (one at each end of the car) and the main controllers. A main controller consists of a series-parallel controlling device and current reverser on the lines of the ordinary hand-working series-parallel controller, driven by a pilot motor which is regulated, through the medium of relays, by the motor controller operated by the driver, these master controllers being merely switching arrangements by means of which small currents are sent through multiple cables to the relays of the main controllers. The multiple cables consist of a number of separate insulated small cables, made up for convenience into one cable, the number of wires depending on the number of movements which it is necessary to be able to transmit to the main controller. The cables are arranged so as to form a "train line"—that is to say, they terminate at each end of the car with couplings—so that when cars are connected together a "jumper," consisting of a short piece of flexible multiple cable containing just as many insulated wires as the cable on the car and multiple couplings at each end to fit those on the cars, may be put across between them and connection made from car to car along the whole length of the train. The couplings and connections are so designed that no matter how the cars are arranged or which way round they are, the motors of all will run in the same direction relative to the direction of motion and be regulated simultaneously. It will thus be seen that a whole train, no matter how long, can be controlled from the master controller at either end of any car, the most logical and usual position for the driver being, of course, the front platform of the front car. It will also be observed that the only current passing from car to car is the small amount required to operate the relays of the main controllers, the main motor current being picked up by each car in the usual way by means of a contact shoe sliding on a third rail or conductor between the rails. This system has been named by Mr. Sprague the "multiple unit system."

Continuing now the advantages which it possesses over a system of locomotive-drawn trains, one of its most striking advantages is the ease with which trains of any length can be made up to suit the requirements of the moment. Owing to the ease

with which cars can be handled—not requiring a locomotive to haul them—those not in actual use can be left in "twos or threes" in sidings at numerous points on a line, just where convenient and ready for use at a moment's notice; trains can then be started from a terminus with only enough cars comfortably to carry the passengers, and if the number of the latter increases as the journey proceeds, cars can be picked up in a few seconds from one of the sidings on the way, and if, on the other hand, passengers dwindle down very considerably, cars can be dropped out anywhere. By this means no superfluous weight in the shape of empty cars need be brought about. A locomotive system does not possess these advantages. Spare cars, for economy's sake, must be grouped together, as they require locomotives to move them when necessary, and the fewer the locomotives required the less will the first cost of the system be. Even when cars are distributed more or less over the line, the operation of picking one up, or dropping one, in the absence of another locomotive, involves uncoupling the locomotive from the train and reconnecting it, in addition to fetching the fresh car and coupling that up, the whole proceeding probably occupying at least ten minutes each time. Consequently, in a locomotive system during light-load hours it is customary to see long trains running when two or three cars would be sufficient to carry the few passengers comfortably. This state of things may be seen to perfection on most of the steam-locomotive systems now so general. Perhaps it will be suggested on behalf of the passenger that, instead of running a number of self-propelling cars together in the form of a train, the same number of cars should be run separately at equal intervals of time, thereby giving a more frequent service; but from the railway company's point of view this would be impossible beyond a certain limit, owing to the number of drivers that would be required and the consequent increase of working expenses, which would do away with one of the chief advantages of the system. The South Side Elevated Railway at Chicago—previously mentioned—is, so far as the writer knows, the only multiple-unit system in operation at the present moment, and considering the remarkable success which has attended it during its short existence of about two years, it seems almost impossible that electric railways on the locomotive system can in future be projected.

Before concluding it might be as well to explain that, although in this comparison it has been assumed, for simplicity of explanation, that all the wheels of the locomotive in that system, and all the wheels of the train in the multiple unit system are driving wheels, in practice this may not always be the most economical arrangement, at any rate as far as the latter system is concerned. The prime cost of motors and equipment may be sufficiently lowered by using only some proportion of the total number of wheels as drivers to make up for the increased cost of working due to the efficiency being lower. The two ways of reducing the number of driving wheels are by sprinkling the train with ordinary trailers—every other car a trailer, say—or by the obvious expedient of using some of the wheels only of each car as drivers. The former plan would probably be the cheaper in first cost, but it does not possess the flexibility of the later, and neither can be compared in efficiency with a system in which all the wheels are drivers.

Effect of Electric Shock on the Nervous System.

TO THE EDITOR OF ELECTRICAL REVIEW:

Having undertaken a special study of the nervous system, I am anxious to learn all possible concerning nervous shock. To that end I have been making personal investigations and somewhat elaborate experiments. Will you kindly ask your readers in your next issue to write to me, giving their sensations either upon receiving a shock or recovering from it? I am anxious to learn if there has been noise in the ears, any feeling of vibration or tingling or impaired vision. I would be grateful to you for calling attention to the matter, and would be pleased to correspond with any one who may address me. Thanking you in advance for your courtesy.

CHARLES H. MERZ, M. D.
P. O. Box 252, Sandusky, Ohio,
November 11.

Compressed-Air Cars in New York to be Replaced.

It was stated in New York city on Monday of this week that the compressed-air cars now in service on the Twenty-eighth and Twenty-ninth street cross-town lines of the Metropolitan Street Railway Company, would be replaced by cars operated on the conduit electric system. No reasons for the change were given, but it is understood that the air cars made too much noise and were not economical.

Concerning High-Speed Telegraphy.

TO THE EDITOR OF ELECTRICAL REVIEW:

In the ELECTRICAL REVIEW of November 1, your note of comment on the Pollak–Virág system of telegraphy makes comparisons between machine telegraphy in general and the Morse system, which I do not think are warranted by the present state of the art in automatic or the daily operation of the Morse. You state that three operations are employed in the use of automatic telegraphy, and leave it to be inferred that but one operation is required for the Morse, and that with the latter system the message requires no translation at the receiving end. The facts are that with the exception of the actual transmission, which, owing to the very high rate of speed of automatic, is hardly worth taking into consideration, the number of operations is the same in both systems. The message transmitted by Morse key is translated by sound on a type-writing machine at the receiving end. A message perforated on a tape and transmitted is translated by sight from a tape on a type-writing machine at the receiving end, the speed of the sound translator is limited to the speed of the sending operator, which, on a quadruplex circuit, New York to Chicago, averages not more than 15 words a minute, while translation from the tape is only limited by the expertness of the type-writing operator, who will easily average 40 words per minute. Assuming, for example, that 1,000 words per minute are to be transmitted between New York and Chicago instead of 1,500, which is too high a speed for that distance, and putting the average speed of the perforator at 20 words per minute, instead of 25, which you give him; 50 perforating operators and 25 type-writing translators, with a man at each end to work the wire, or 77 persons in all, and a single wire would be required. To transmit the same number of words by the quadruplex Morse system at an average of 15 words per minute for each circuit, 66 sending, 66 receiving operators and 17 wires would be necessary. Thus the Morse would require two-fifths more operators than the automatic to handle the same amount of work, and the wages of the Morse operators would be at least one-third greater, while the number of wires employed would be 17 to 1. The original cost of construction and maintenance of the 16 extra wires, together with the difference in wages and the number of employés, shows the enormous economic advantages of the automatic system.

Instead of being slower, as you assume, the automatic would be uniformly quicker than the Morse in handling any considerable volume of business, since the delay of perforating messages is more than counterbalanced by the interruptions to quadruplex working by reason of frequent "balancing" and adjustment of repeaters, 17 of which, with their expert attendance, would be required at some intermediate point between New York and Chicago.

With reference to the Pollak–Virág system, I have only to say that it seems to me to be a long step backwards. It has been demonstrated in this country that automatic transmission, with perfect recording, is practicable at speeds three times greater than that claimed for the Austrian method, and this without the use of any photographic or other hampering device.

There is no more justification for the use of the camera in telegraphy than there would be in photographing the letters of a type-writing machine, as they appear in view under pressure of the keys instead of allowing them to strike the ink-band and print direct. Furthermore, photographing the movements of an electro-magnet armature or suspended coil is not new, it having been done by M. Ader on the French lines and cables three years ago.

PATRICK B. DELANY.
South Orange, N. J., November 6.

Where to Get Profile Maps.

TO THE EDITOR OF ELECTRICAL REVIEW:

"Who makes profile maps?" See page 303, ELECTRICAL REVIEW, November 8, 1899, signed M. K. Eyre.

Mr. Eyre will find a lot of valuable information in "50 Miles Around New York," a book published by the New York Division, L. A. W.

It gives good road routes in every direction, shows grades, distances, condition of roads, etc.

Is published for the use of L. A. W. members, but may be had by others at $2 per copy.

Information may be obtained from W. S. Bull, secretary, Vanderbilt Building, New York city.

I advise Mr. Eyre to join the L. A. W., and he may then take advantage of the privilege which members have of writing to the L. A. W. "Touring Department" at any time for special information.

No. 136,206,
Connecticut Division, L. A. W.
Torrington, Ct., November 11.

SCIENCE BREVITIES.

Plating of Aluminum with Silver, Gold, Copper and Nickel — MM. Lanseigne and Leblanc, in the *Jour. de Pharm. et de Chimie*, give the following for electrolytic baths: For plating with silver, 20 gr. of nitrate of silver, 40 gr. of cyanide of potassium, 40 gr. phosphate of soda, 1,000 gr. water. For plating with copper, 300 gr. cyanide of copper, 450 gr. cyanide of potassium, 450 gr. phosphate of soda, 5,000 gr. water. For plating with gold, 40 gr. of chloride of gold, 40 gr. of cyanide of potassium, 40 gr. phosphate of soda and 2,000 gr. water. For plating with nickel, 70 gr. chloride of nickel, 70 gr. phosphate of soda, 1,000 gr. water. The baths are to be heated up to 140 degrees to 158 degrees Fahrenheit, and to be kept at this temperature. The anodes must consist of the same metal which is dissolved in the bath.

The Genesis of the Electric Spark—An Italian contemporary abstracts a communication by Herr B. Walter to *Wiedemann's Annalen* on the above subject. The author believes that the electric spark in traversing a dielectric does not rush through in one sudden effort, but finds the way through successive brush discharges which reach out from the two electrodes and finally join. The author's observations were made with a 24-inch spark coil having a motor-driven mercury interrupter. The primary condenser was cut out to make the duration of the spark as long as possible. By photographic methods it was shown that the principal spark was preceded by four preliminary sparks. The tuft growing out from the positive terminal was four or five times as long as that from the negative and considerably more spread out. Its principal ramification became part of the track of the final spark.

Electrolytic Conduction in Solids—Professor H. Nernst gives, in the *Zeitschrift für Elektrochemie*, the results of his interesting experiments on the above subject. They go to show that solids can conduct electrolytically, and that, at high temperatures, the conductivity is markedly increased. The author believes that in the transparency of a substance of the character experimented upon is found the criterion whether or not its conductivity is of the electrolytic order. It is well known that, according to the electromagnetic theory of light, metals are not transparent, possessing the property of converting light rays into heat, but that electrolytes are transparent, since they are insulators for the rapid electrical oscillations which go to make a beam of light. The proof that this conductivity in Nernst lamp filaments which the author used is electrolytic is the polarizing, due to direct current and the reduction of the metallic part on the cathode. At the high temperature of incandescence the filaments that the author used seemed to conduct almost as well as metal.

A Gutta Percha Plant for Temperate Climates—MM. Dybrowski and Fron have presented a note to the Académie des Sciences upon a plant which can be grown in temperate climates for the production of gutta percha. It is well known that to-day the principal product comes from trees which are confined in their habitat to tropical regions. The tree that these experimenters have been working with is known as the *Eucomia ulmoides*. This was described originally in the bulletin of the Linnæan Society, of London, in 1892. The results were surprisingly good. The gum produced is of a brown color, with a semi-metallic lustre. It becomes soft in warm water, and in most respects behaves like the ordinary guttas. The tree is at present known only in the north of China. It seems to be propagated easily by cuttings. In Paris it appears to have stood the Winter climate well, and it is believed that it can be grown successfully in temperate or semi-tropical climates. If this is true it will be of enormous importance in a few years, as the visible supply of gutta percha in the Malay Peninsula is decidedly small.

Vacuum Interrupter—In 1896 Mr. MacFarlane Moore exhibited before the American Institute of Electrical Engineers a new device for electric illumination, by which vacuum tubes, with or without electrodes, were made to yield a continuous light of several candle-power without the use of an induction coil. The device was based upon the employment of a Wagner hammer-interrupter vibrating in a vacuum, and producing a very abrupt and perfect break. The self-induction in a short primary coil then sufficed to produce a train of sparks or the illumination of a vacuum tube. The high expectations attached to this interesting contrivance do not seem to have been realized, probably owing to the fact that the hammer is liable to stick, and the current then melts off the point of contact. To avoid this, Herren J. Elster and H. Geitel keep the hammer vibrating by means of a separate electro-magnet outside the vacuum tube actuated by a mercury interrupter of the Roget spiral type. The spiral and the hammer are tuned to unison, but even so the light obtained is somewhat fitful and less steady, though safer, than the light obtained by Moore, says one of Mr. E. E. Fournier d'Albe's abstracts.

Sounds Emitted by the Electric Arc—Mr. F. J. Jervis-Smith, writing in the *Electrician*, says: The sensitiveness of the electric arc to electrical changes in a supply system is probably well known to all persons who use arc lamps. While making certain experiments with the electrolytic break, I thought that it would be interesting to find out how far the break, when working, would affect an electric arc when burning steadily. An electric lamp by Serrin was fed from the company's mains through a resistance sufficient to reduce the current to about five amperes. The current was continuous at a pressure of 100 volts. In a room about sixty feet distant from the lamp an electrolytic break was used in connection with a coil of wire, in length about fifty feet, furnished with a small core, and also supplied from the company's mains. At each closing of the break circuit the arc gave out a loud, clear note of the same pitch as that of the break. I found that the best condition was obtained by making the arc long and quiet-burning by an old method of mine—viz., by introducing a little powdered glass into the core hole of the positive carbon. The note then produced was unpleasantly loud to a person standing at a distance of four feet from the lamp. My next experiment was to remove the electrolytic break to a point about a mile distant from the lamp. When the circuit of the break was closed the same effect was produced, but in a less degree, but enough sound was given out to receive a Morse code message at a distance of ten to twelve feet from the lamp. In this latter case the electrolytic break was driven off the company's mains.

The Constant of Gravitation—The constant of gravitation has been the object of several investigations, involving extremely delicate experimental work. The method most favored has undoubtedly been that of Cavendish, which consists in comparing, by means of the torsion balance, invented by the Rev. John Mitchell, the relative attractions of a pair of massive metal balls, and of the earth, on a pair of smaller balls suspended from the arm of a torsion balance. As the experiment is ordinarily arranged, some of the quantities to be accurately measured are exceedingly minute. Thus, in Professor Boys's apparatus the torsion couple measured was equivalent to the $\frac{1}{12.000.000}$ of a grain acting on the arm of a lever 1 inch long, and the total angular deflection observed was but ¾ degree. In the apparatus used by the other experimenters the torsion couple has been greater, but the angular deflection has not been more than, say, 30 minutes. With a view to avoiding the difficulties involved in the accurate determination of such extremely small quantities, says *Engineering*, Mr. G. K. Burgess has recently experimented at the laboratory of M. Lippmann at Paris with an apparatus in which the angular deflection observed has attained the substantial figure of 12 degrees. This he has accomplished by using large balls, weighing 2 kilogrammes, as his suspended masses, the weight of which is, however, almost exactly balanced by immersing them in a bath of mercury. The very small excess weight left can then be supported by a very fine fibre, which accordingly permits the measurement of a very small torsion couple. In Professor Boys's experiments the balls of the suspended system were of gold, 0.2 inch and 0.25 inch in diameter, and weighing, therefore, only a small fraction of an ounce. The weights used by Mr. Burgess are completely immersed in the mercury bath, being suspended from the balance arms by platinum wires less than $\frac{1}{20}$ millimetre thick. The fixed attracting masses are of lead, and weigh 10 kilogrammes each, and their attraction on the suspended masses is sufficient, as already stated, to deflect the balance an angle of 12 degrees. The principal difficulties encountered in the experiments has in the first place been the necessity of maintaining the mercury bath at an absolutely constant temperature. Any changes in its density will, of course, alter the fraction of the total weight carried by the balance. The second drawback to the arrangements has been found in the surface-tension effects between the suspending wires and the mercury; but these have been successfully met by covering the surface of the latter with a thin layer of sulphuric ether, whilst by keeping the apparatus in a cellar it has been possible to avoid objectionable changes of temperature. So far the preliminary experiments go to show that the arrangement may give very concordant and reliable results.

ELECTROSTATIC ROTATION.

BY ALFRED G. DELL.

In the Leyden jar experiments described in an article published in the ELECTRICAL REVIEW of November 1, 1889, in order to send the positive charge on one wire and the negative on another I arranged two pieces of light steel spring so that the tin-foil on the pendulum would strike one of them on its arrival at each pole of the machine, otherwise there being no electrical connection between the machine or jars and the springs. To each piece of spring I attached a wire to lead away the charge on contact. In the ELECTRICAL REVIEW of the same date there is a description and cut of what is called electrostatic

ELECTROSTATIC ROTATION.

rotation. I constructed something like it, and refer to the above-mentioned cut in my description. I made the disk M of cardboard, 3¼ inches diameter. At opposite ends of a diameter of the cardboard I glued two pieces of tin-foil, extending one around the side to within ¾ inch of the other. To each piece of tin-foil I attached one of the wires leading to a spring which is struck by the pendulum swinging between the poles of the Leyden jars attached to the Wimshurst influence machine.

I describe it now exactly as it is constructed, but am sure it can be improved.

The disk D in the figure I made of mica, about 2¼ inches diameter, and placed it within ¼ inch of the piece of cardboard containing the tin-foil. On turning the machine and starting the pendulum the mica disk rotated. Say *a* in the figure is the smaller piece of tin-foil and *b* the larger, it rotated from *a* to *b* always, no difference which was made positive or negative. In the dark a bright discharge can be sent at the positive side between the tin-foil and mica. It would not rotate for me when the two pieces of tin-foil were of the same size. I found the experiment rather difficult to make, but when it worked the disk turned well, its velocity depending upon the strength of the discharges, and did not stop until the jars were well on their way to discharge.

ITEMS OF INTEREST.

The rumor that the Boston Elevated Railroad Company is substituting aluminum for copper wire has been denied.

General Otis has reported to the War Department that the cable-ship Hooker, which went ashore at Corregidor Island in Manila Bay, is a total wreck and can not be saved.

The Edison Electric Illuminating Company of Boston has increased its capital stock from $3,920,000 to $4,312,000. The largest stockholder is Mr. J. Pierpont Morgan, of New York, who holds 2,481 shares.

The number of passengers carried on the elevated railroads in New York city decreased this year 2,523,000 from 1898 and 41,417,000, or nearly twenty per cent from the high-water mark of elevated traffic in 1893.

The Montclair, N. J., Town Council has passed an amended ordinance granting to the North Jersey Street Railway Company a franchise for a street railway to the south end of the town through Elm street and Orange road to the Orange line. The ordinance provides for a ten-cent fare to Orange from Montclair when a direct route is made.

Three schemes in color printing in very different manners are shown in the Christmas *Scribner's*. The cover by Maxfield Parrish has been reproduced by lithography in nine printings. The Appleton Clark illustrations are reproduced from half-tone plates with four printings. The Glackens illustrations are made by a similar process. In addition to these schemes of color, the Gibson illustrations appear on a tint background.

A Chicago paper says that after repeated efforts to merge the three Southside suburban electric railroad companies into one, the promoters are understood to have reached a working basis. The new company will have a capital of not less than $10,000,000 and will buy outright the South Chicago City Railway, Calumet Electric and Chicago Electric Traction companies. There is also report that the Chicago City Railway Company will lease to the new corporation all its present extensions south of Sixty-third street, making that the dividing line for a double fare.

A Remarkable Wireless Telegraphy Patent of 1872.

TO THE EDITOR OF ELECTRICAL REVIEW:

Has the Loomis patent for telegraphing without wires been published lately? I have not noticed it, and therefore send you a copy. Before the new controversy is settled, the experts and lawyers will have a chance to try their teeth on the nuts this document contains.

Loomis got an act of incorporation for his company, had considerable money subscribed by investors and made many experiments, principally in the mountains of Virginia. If the facilities for such work now available had been at hand, he would probably have accomplished something important. He died in the full belief that his invention was a revolutionary one.

GEO. C. MAYNARD.

Washington, D. C., Nov. 10.

The patent referred to by Mr. Maynard is a curious document. It was granted to Mahlon Loomis, of Washington, D. C., on July 30, 1872. After the usual formal beginning it is, in full, as follows:

"The nature of my invention or discovery consists, in general terms, of utilizing natural electricity and establishing an electrical current or circuit for telegraphic and other purposes without the aid of wires, artificial batteries, or cables to form such electrical circuit, and yet communicate from one continent of the globe to another.

"To enable others skilled in electrical science to make use of my discovery, I will proceed to describe the arrangements and mode of operation.

"As in dispensing with the double wire (which was first used in telegraphing) and making use of but one, substituting the earth instead of a wire to form one-half the circuit, so I now dispense with both wires, using the earth as one-half the circuit and the continuous electrical element far above the earth's surface for the other part of the circuit. I also dispense with all artificial batteries, but use the free electricity of the atmosphere, cooperating with that of the earth, to supply the electrical dynamic force or current for telegraphing and for other useful purposes, such as light, heat and motive power.

"As atmospheric electricity is found more and more abundant when moisture, clouds, heated currents of air and other dissipating influences are left below and a greater altitude attained, my plan is to seek as high an elevation as practicable on the tops of high mountains, and thus penetrate or establish electrical connection with the atmospheric stratum or ocean overlying local disturbances. Upon these mountain-tops I erect suitable towers and apparatus to attract the electricity, or, in other words, to disturb the electrical equilibrium, and thus obtain a current of electricity, or shocks or pulsations, which traverse or disturb the positive electrical body of the atmosphere above and between two given points by communicating it to the negative electrical body in the earth below, to form the electrical circuit.

"I deem it expedient to use an insulated wire or conductor as forming a part of the local apparatus and for conducting the electricity down to the foot of the mountain, or as far away as may be convenient for a telegraph office, or to utilize it for other purposes.

"I do not claim any new keyboard nor any new alphabet or signals; I do not claim any new register or recording instrument, but what I claim as my invention or discovery, and desire to secure by Letters Patent, is the utilization of natural electricity from elevated points by connecting the opposite polarity of the celestial and terrestrial bodies of electricity at different points by suitable conductors, and, for telegraphic purposes, relying upon the disturbance produced in the two electro-opposite bodies (of the earth and atmosphere) by an interruption of the continuity of one of the conductors from the electrical body being indicated upon its opposite or corresponding terminus, and thus producing a circuit or communication between the two without an artificial battery or the further use of wires or cables to connect the cooperating stations."

The New York & Pennsylvania Telegraph and Telephone Company has given a mortgage of $1,000,000 on its lines to the Washington Trust Company, of New York, the document being filed at the County Clerk's office in Binghamton, N. Y. The mortgage is to cover bonds issued by the telephone company to the amount of $300,000. The money is to be used in extending the company's lines through New York and Pennsylvania and strengthen the present system. In order to provide for further extension and paying the bonds the company has authorized the issue of $1,000,000 worth of four per cent interest bearing bonds, payable November 1, 1919.

Electrical Review

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CHARLES W. PRICE, - - - - - - - EDITOR.
STEPHEN L. COLES, - - MANAGING EDITOR.
CHARLES T. CHILD, - - TECHNICAL EDITOR.
STEPHEN H. GODDARD, ADVERTISING MANAGER.

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RUSSELL HOWLAND, GENERAL REPRESENTATIVE,
Times Building, 41 Park Row.

WESTERN OFFICE:
FRANK E. COLBERT, REPRESENTATIVE,
935 Old Colony Building, Chicago.

WASHINGTON OFFICE:
GEO. C. MAYNARD, - REPRESENTATIVE,
Room 102, Washington Loan and Trust Building,
WASHINGTON, D. C.

LONDON OFFICE:
HENRY W. HALL, - - REPRESENTATIVE,
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TECHNICAL EDUCATION.

On another page appears a reprint of an editorial comment by a British journal upon the present current opinion that the decay of British eminence in manufacture is due to a lack of technical education among British workmen. With this claim our contemporary does not agree; it holds rather that the backwardness of Britain to-day is due not so much to a lack of technical knowledge by workmen as to a lack of business knowledge by the moving spirits of her commercial enterprises. This is perhaps a true statement of the facts, for it can certainly be argued that the possession of purely scientific knowledge does not make a man a better handicraftsman and, indeed, that it may somewhat unfit him for the manual duties to which his station calls him. Obviously this view of the matter is one which may provoke much argument, and the question is one well open on both sides. Does or does not the teaching of the purely scientific side of engineering to the man who has to do the work in the mill, the factory, or the yard, help him or hinder him in the performance of his actual duties? On the one side it may be said that such instruction unfits the man for coarser work with his hands and fills his mind with ideas and aspirations which he can not gratify, thereby rendering him discontented and correspondingly of little value. On the other hand it may be said that without this higher knowledge the man in the shop becomes as one of the machines which he attends and has no inspiration to better things, feels handicapped by his lack of knowledge and becomes soddenly content with his lot as a part of the producing plant. Nevertheless, so long as we admit that the conditions of industry (and indeed of humanity) necessitate the division of men into classes, we must believe that that instruction which best fits a man for his immediate duty will produce the best man for that duty. If technical instruction tends to raise a race of engineers, where will we look for the workers to carry out their designs? In this country there has been far too much technical and engineering education. Our schools have turned out, for several years past, a number of engineering graduates entirely in excess of the demand for this class of men in our industries, but where have we a school that has turned out the faithful mechanic who feels that a true surface, a straight edge, a neat fit, or a good finish, are things to be desired and ends to be attained? We have, as our contemporary says they have also in England, too many engineers and too few workmen.

AN INTERNATIONAL CABLE CONFERENCE.

In the recent annual report of General A. W. Greely, the chief signal officer of the United States Army, he advocates an international cable conference to consider the subject of the rights, privileges and immunities of submarine cable property in time of war. This suggestion is one so eminently in line with the spirit of the times that it is not unlikely that it will be taken up by the government and carried forward. The vast property represented by submarine cables—a property which is of the utmost and most urgent importance to all sorts of people all over the world—is so situated, in the very nature of things, that no one government, however strong, can give it protection. It will require international cooperation to secure for the cables the immunity which they properly should have.

The question of the right of combatants to destroy cable property is, of course, one that belongs to the province of international law. But so far there has been no definition of the status of cable property, and there is no precedent as yet for the settlement of claims for damages arising out of its destruction by belligerents. It is clearly necessary from a military point of view that the working of a cable may, at times, require to be stopped. We have had recent instances of this military necessity, and every naval war of the future will certainly produce similar situations. The question is not necessarily to devise means for preventing the cutting or destruction of cables in warfare, but to prescribe rules to govern combatants in dealing with such matters, and also to settle the status of cable owners as against governments when they come to sue for the recovery of damages inflicted upon them. It would seem that there is no reason why an international understanding on these points may not easily be reached.

There seems to be some prospect that at last the automobile will be allowed in the parks of New York city. We had been under the impression for a long time that the parks belonged to the people, and that any proper recreation not detrimental to the rights and happiness of others was lawful and proper to be conducted in them. The autocratic Board of Park Commissioners of New York city has ruled out the automobile, and a test case is now being tried, a martyr to the faith having allowed himself to be arrested and haled into court for taking his electromobile into Central Park. In the course of time he will win, but meanwhile this is one of the little annoyances that automobilism has to suffer, as does every other new art.

It is stated that the compressed-air cars, which have been making a howling wilderness of Twenty-eighth and Twenty-ninth streets in New York city for several months past, are to be replaced with electric cars on the conduit system. The only curious thing about this is that there should have been so much delay about the replacement. It is to be hoped that no more money will be spent in retrying the foredoomed experiment of running compressed-air cars. If any one would write a book on the history of compressed-air traction failures in the last twenty years he could make an interesting document. In many parts of the world the scheme has been faithfully tried and invariably with the same result. Now that these noisy and inefficient contrivances are to disappear from our streets, may not New Yorkers hope to see, as well, the last of the horse as a propelling mechanism for a street car?

AUTOMOBILE NEWS.

A Paris newspaper recently published statistics which show that in a certain period only 1 death and 33 injuries were caused by automobiles, and during this time 67 deaths and 745 injuries were caused by vehicles drawn by horses.

The boiler inspection squad of the New York city Police Department has asked the Commissioners for instructions as to whether automobiles having steam boilers must be inspected, and whether their operators must be licensed engineers.

The gasoline tank of an automobile owned by Charles Kranich exploded at Fifth avenue and 120th street, New York city, on November 8. Mr. Kranich, who was operating the automobile, was badly burned about the face and hands. He has owned the vehicle only for a few weeks.

The first automobile runaway in Cleveland occurred on the public square the other day. The operator got out to fix some of the machinery. He was tinkering with it when the machine started up. There was a great scampering of people to get out of the way. The owner overtook the flying machine, jumped in and stopped it.

Dr. R. J. Gatling, the famous inventor of the rapid-firing gun bearing his name, is reported to have invented an automobile plow. It will be operated by one man, and is expected to accomplish the work of eight men and twelve horses. Ordinary disk plows will be used. Dr. Gatling will not give details of construction at the present time.

Postmaster Wilson, of Brooklyn, N. Y., is planning to use automobiles for the delivery of mail in that borough. After considerable study of the question, Mr. Wilson is said to be ready to report to the Washington authorities that his plan, if adopted, would bring about a great improvement in the service. It is said that if this scheme is carried into effect, the present trolley-car postal service will be done away with. Mr. Wilson is understood to favor, at the present time, automobiles using gasoline for fuel.

The New York city Park Board gave a public hearing on November 9 on the question of admitting automobiles to Central Park. Twenty men and one woman announced that they were ready to speak on the subject. Lawson N. Fuller said that he had driven horses for fifty-six years, and that any objection to the admission of automobiles to Central Park on the ground that they would frighten horses was a mistake. He said that the average horse was intelligent enough to become accustomed to automobiles very quickly. Several persons spoke against admitting automobiles to the Park. The Board reserved decision.

It is reported by a French publication that there are now more than 7,000 owners of automobiles in Europe, the number of such vehicles being, perhaps, 10,000, nearly two-thirds of these being owned in France. Out of this number, no less than 4,541 are in the departments. There are more than 600 manufacturers in France, not including the makers of parts, about 1,000 dealers in them, and 1,100 repair shops. The same authority gives the number of owners of automobiles in Germany as 268, 90 in Austria-Hungary, the same in Belgium, 44 in Spain, 304 in Great Britain, 111 in Italy, 68 in Holland, 114 in Switzerland.

Electromobile Omnibuses for Fifth Avenue, New York.

It is stated on good authority that the New York Electric Vehicle Transportation Company has acquired the franchises and equipment of the Fifth Avenue Stage Company. The Elliot F. Shepard Estate sold the property to the Third avenue railroad interests, who sold it to William C. Whitney, from whom the present purchasers take it. They pay him $1,000,000 for it. His son, Harry Payne Whitney, is president of the Electric Vehicle Transportation Company.

The Fifth avenue line is to be equipped with electric omnibuses as soon as they can be built. Orders have been placed for a large number of the vehicles, and they are being constructed at the works of the Electric Vehicle Company at Hartford. It is expected that they will be ready to put on the line by May, 1900.

Automobiles in New York Parks.

At last a permit has been granted to an automobilist to enter Central Park with his machine. Park Commissioner G. C. Clausen, who has moved in this matter with the utmost caution, went out for a ride with Mr. R. A. C. Smith of this city in an electromobile last Sunday. Surrounded by a cohort of mounted policemen, the machine made a tour of the Park, the object being for the Commissioner to satisfy himself that horses would not take alarm at the appearance of the electromobile. He was so well pleased with the test that, as soon as the trip was over, he granted Mr. Smith permit No. 1.

Magnetic Blow-Out Patent Declared Invalid.

The Thomson-Houston Electric Company brought suit some time ago against the Nassau Electric Railroad Company, of Brooklyn, N. Y., charging infringement of letters patent No. 283,167, issued August 14, 1883, to the Thomson-Houston Electric Company as assignee of Professor Elihu Thomson, the inventor. The suit was argued upon the pleadings and proofs before Judge Edward B. Thomas in the United States Circuit Court for the Eastern District of New York. Judge Thomas, at final hearing on November 10, filed an opinion in which he dismisses the suit of the Thomson-Houston Electric Company upon the ground of invalidity of the patent. The Nassau Electric Railroad Company was defended by the Lorain Steel Company, whose apparatus it was sued for using.

A similar suit is pending against the Bullock Electric Manufacturing Company in the Southern District of New York, and has been argued upon pleadings and proofs before Judge Hoyt H. Wheeler. The last-named suit is now awaiting decision by Judge Wheeler.

The patent involved is the broad basic patent that is so well known to the art.

An Opinion on the Sprague Motor Suspension Patent.

Judge Edward B. Thomas, in the United States Circuit Court for the Eastern District of New York, rendered an opinion on November 10, respecting the Sprague motor suspension patent that has heretofore figured in litigation against the Walker Company prior to its consolidation with the General Electric Co. The court construes claims 2 and 6 of the motor suspension patent No. 324,892 differently from the construction heretofore given to that patent, and holds those claims to be good and valid and infringed. The name of this case is Sprague Electric Railway and Motor Company *vs.* Nassau Electric Railroad Company, and it was defended by the Lorain Steel Company.

Opening of the New Main Telephone Exchange in Brooklyn, N. Y.

On the evening of November 13, the new common-battery main exchange of the New York & New Jersey Telephone Company at Brooklyn, which was fully described in the ELECTRICAL REVIEW of November 1, was opened for service.

PERSONAL.

Mr. J. F. Stevens, president of the Keystone Electrical Instrument Company, Philadelphia, was among the out-of-town visitors to New York city last week.

Mr. Robert T. Lozier, New York manager for the Bullock Electric Manufacturing Company, Cincinnati, sailed for Europe on Wednesday of this week on the Oceanic.

Mr. M. E. Baird, Chicago manager for the Eddy Electric Manufacturing Company, of Windsor, Ct., made a brief visit to New York and other eastern cities last week.

Mr. W. A. Ross, for many years with the Babcock & Wilcox Company, has resigned, to go into business on his own account with the Acme Stoker Company, 15 Cortlandt street, New York city.

Mr. William Leslie Edison, a son of Mr. Thomas A. Edison, and Miss Blanche Fowler Travers, daughter of the late Dr. Edward Travers, of Maryland, were married at Elizabeth, New Jersey, on November 7.

Mr. and Mrs. Edward Lloyd have announced the marriage of their daughter, Elizabeth Phoebe Key, to Mr. Roger Upton, president of the Standard Thermometer and Electric Company, Peabody, Mass., on Wednesday, October 25, at Wye House, Maryland.

Mr. William T. McDowell, who has been identified with the electric light station at Red Bank, N. J., has recently taken the management of an office for construction work and the sale of electrical supplies at Elizabeth, N. J., for the Electric Motor and Equipment Company, of Newark, N. J.

Mr. James P. McQuaide, the secretary and treasurer of the National Conduit and Cable Company, in addition to his technical and professional duties, is quite an extensive fruit grower on his country place at Nyack, N. Y. Mr. McQuaide makes the very well substantiated claim that no better apples than the soil of that vicinity produces are to be found in the state.

Mr. W. W. Burnham, former manager of the Electric Gas Lighting Company, of Boston, has severed his 15 years' connection with that concern, and is now associated with the well known house of Stanley & Patterson, dealers in electrical supplies, of New York city. Mr. Burnham will have charge of the firm's correspondence and other office matters. The ELECTRICAL REVIEW takes pleasure in welcoming Mr. Burnham to a broader field of work in New York.

THE NATURE OF PHYSICAL LAWS.

BY PROFESSOR J. H. POYNTING, F. R. S.

(*Concluded from page 298*)

Then Faraday's discovery of the influence of the dielectric medium in electric actions led to the general abandonment of the idea of action at a distance, and the ether was called in to aid matter in the explanation of electric and magnetic phenomena. The discovery that the velocity of electro-magnetic waves is the same as that of light waves is at least circumstantial evidence that the same medium transmits both.

So, as we watch the weaving of the garment of Nature, we resolve it in imagination into threads of ether spangled over with beads of matter. We look still closer, and the beads of matter vanish; they are mere knots and loops in the threads of ether.

The question now faces us—How are we to regard these hypotheses as to the constitution of matter and the connecting ether? How are we to look upon the explanations they afford? Are we to put atoms and ether on an equal footing with the phenomena observed by our senses, as truths to be investigated for their own sake? Or are they mere tools in the search for truth, liable to be worn out or superseded?

That matter is grained in structure is hardly more than the expression of the fact that in very thin layers it ceases to behave as in thicker layers. But when we pass on from this general statement and give definite form to the granules or assume definite qualities to the intergranular cement, we are dealing with pure hypotheses.

It is hardly possible to think that we shall ever see an atom or handle the ether. We make no attempt whatever to render them evident to the senses. We connect observed conditions and changes in gross visible matter by invisible molecular and ethereal machinery. The changes at each end of the machinery of which we seek to give an account are in gross matter, and this gross matter is our only instrument of detection, and we never receive direct sense impressions of the imagined atoms or the intervening ether. To a strictly descriptive physicist their only use and interest would lie in their service in prediction of the changes which are to take place in gross matter.

There is more serious danger of confusion of hypothesis with fact in the use of the ether, more risk of failure to see what is accomplished by its aid. In giving an account of light, for instance, the right course, it appears to me, is to describe the phenomena and lay down the laws under which they are grouped, leaving it an open question what it is that waves, until the phenomena oblige us to introduce something more than matter; until we see what properties we must assign to the ether—properties not possessed by matter—in order that it may be competent to afford the explanations we seek. We should then realize more clearly that it is the constitution of matter which we have imagined, the hypothesis of discrete particles, which oblige us to assume an intervening medium to carry on the disturbance from particle to particle. But the vortex-atom hypothesis and Dr. Larmor's strain-atom hypothesis both seem to indicate that we are moving in the direction between matter and ether; that we shall come to regard the luminiferous medium not as an attenuated substance here and there encumbered with detached blocks—the molecules of matter—but as something which in certain places exhibits modifications which we term matter. Or, starting rather from matter, we may come to think of matter as no longer consisting of separated granules, but as a continuum with properties grouped round the centres, which we regard as atoms or molecules.

Perhaps I may illustrate the danger in the use of the conception of the ether by considering the common way of describing the electro-magnetic waves, which are all about us here, as ether waves. Now in all cases with which we are acquainted, these waves start from matter; their energy before starting was, as far as we can guess, energy of the matter between the different parts of the source, and they manifest themselves in the receiver as energy of matter. As they travel through the air, I believe that it is quite possible that the electric energy can be expressed in terms of the molecules of air in their path, that they are effecting atomic separations as they go. If so, then the air is quite as much concerned in their propagation as the ether between its molecules. In any case, to term them ether waves is to prejudge the question before we have sufficient evidence.

The discussion of the physical method, with its descriptive laws and explanations, and its hypothetical extension of description, leads us on to the consideration of the limitation of its range. The method was developed in the study of matter which we describe as non-living, and with non-living matter the method has sufficed for the particular purposes of the physicist. Of course only a little corner of the universe has been explored, but in the study of non-living matter we have come to no impassable gulfs, no chasms across which we can not throw bridges of hypothesis. Does the method equally suffice when it is applied to living matter? Can we give a purely physical account of such matter, likening its motions and changes to other motions and changes already observed, and so explaining them? Can we group them in laws which will enable us to predict future conditions and positions? The ancient question never answered, but never ceasing to press for an answer.

Having faith in our descriptive method, let us use it to describe our real attitude on the question. Do we, or do we not, as a matter of fact, make any attempt to apply the physical method to describe and explain those notions of matter which, on the psychical view, we term voluntary?

Any commonplace example—and the more commonplace the more is it to the point—will at once tell us our practice, whatever may be our theory. For instance, a steamer is going across the Channel. We can give a fairly good physical account of the motion of the steamer. We can describe how the energy stored in the coal passes out through the boiler into the machinery, and how it is ultimately absorbed by the sea. And the machinery once started we can give an account of the action and reaction between its various parts and the water, and, if only the crew will not interfere, we can predict with some approach to correctness how the vessel will run. All these processes can be likened to processes already studied—perhaps on another scale—in our laboratories, and from the similarities prediction is possible. But now think of a passenger on board who has received an invitation to take the journey. It is simply a matter of fact that we make no attempt at a complete physical account and explanation of those actions which he takes to accomplish his purpose. We trace no lines of induction in the ether connecting him with his friends across the Channel, we seek no law of force under which he moves. In practice the strictest physicist abandons the physical view, and replaces it by the psychical. He admits the study of purpose as well as the study of motion.

If we have full confidence in the descriptive methods, as applied to living and non-living matter, it appears to me that up to the present it teaches us that while in non-living matter we can always find similarities, that while each event is like other events, actual or imagined, in a living being there are always dissimilarities. Taking the psychical view—the only view which we really do at present take—in the living being there is always some individuality, something different from any other living being, and full prediction in the physical senses, and by physical methods is impossible. If this be true the loom of Nature is weaving a pattern with no mere geometrical design. The threads of life, coming in we know not where, now twining together, now dividing, are weaving patterns of their own, ever increasing in intricacy, ever gaining in beauty.

Photometry of Incandescent Lamps.

The accurate measurement of the luminosity of an incandescent lamp is complicated by the want of symmetry in the emission and by reflections from the glass wall. Herr E. Liebenthal communicates to a German contemporary an exhaustive theoretical and practical treatise on this subject, abstracted in the *Electrician*, which is of considerable value to electrical engineers. He distinguishes four general types of lamp filaments. The simplest is a straight filament stretched between terminals entering on two sides. The second type is the simple curved filament, hollow or solid, single or in pairs variously disposed. The third type is looped, and here, again, four different arrangements may be distinguished. The fourth is the filament of wavy outline. Of these types the first is not in practical use. The second shows the greatest regularity in the distribution of the light round the axis of the bulb. The third type shows strong reflections in two opposite directions, and the fourth shows decided minima in the plane containing the terminal points of the filament. To obtain an average luminosity characterizing the lamp as a whole the *Verband Deutscher Elektrotechniker* adopts a system of two mirrors, showing the lamp as seen from three different points simultaneously. It has also been proposed to make the lamp revolve about its axis, but this leads to a centrifugal deformation of the filament.

Steps will be taken to establish a municipal lighting plant at Galena, Ill., at a cost of $12,000.

Technical Education.

The *Practical Engineer*, of Manchester, England, in a recent issue comments at length on technical education. Its remarks are so clear a reflection of the present state of industrial affairs in Great Britain that they are worthy of reproduction in full:

The decay which now, for a period of over a quarter of a century, has been slowly but surely taking place in the industrial and commercial power of this country, says our contemporary, and the facts which must now be patent to even the most purblind, that Germany has to-day the complete control over certain industries which a comparatively short time ago were British monopolies, whilst the supremacy in the iron and steel trade which the English nation might be pardoned from long habit for having got to look upon as a birthright, has passed into the hands of the United States, the output of the latter country for the current year being 13,500,000 tons, against our 9,000,000 tons. These facts, we say, now past dispute, have not unnaturally drawn considerable attention to the devising of a remedy for so unsatisfactory a state of things; and it seems to have become universally acknowledged that the only practically available one is to improve the technical education of the British workman.

That this is the true and only remedy for the evil, as so many seem to think, we are not prepared to admit, whilst allowing that it forms an important factor in the prosperity of the manufacturing trade of this, as it does of every other, country.

As regards the value of a scientific training to those who are called upon to occupy the higher or leading positions in a manufacturing business, of any nature whatsoever, no reasonable doubt can exist. To an engineering student — and in this country industrial pursuits are engineering pursuits—such technical training has become a necessity, for but few amongst us are endowed with that gift known as intuition, which, when combined with practical experience, enables the assistance of theoretical training to be dispensed with.

But even with this class of student the manner of attaining this scientific training is a matter of the greatest importance. It is not sufficient, nor indeed, is it of any practical value to the student, to find himself, at the termination of a college course, simply saturated with theories and deductions; what is required in an ideal course of scientific training is to inspire the student, and to teach him to work for himself. When instructing his assistants and pupils, George Stephenson was wont to say: "Learn for yourselves, think for yourselves, make yourselves masters of principle; persevere, be industrious, and there is then no fear of your success;" and this is the true gospel of instruction. In no better language could the true requirements of a college course of engineering be expressed than that which was recently put by Professor D. C. Jackson, in the discussion on a paper by Professor C. Frank Allen, before the Society for the Promotion of Engineering Education: "The college course in engineering," said he, "should be bent toward such a complete and true representation of thorough science and truth that the student is incited to permanently secure it for himself and make it fully his own, and it may then be put to valuable use in future practice." To the student in engineering, it should always be remembered, the laboratory is of incalculable value, for there he can gain an insight into the actual relations which exist between pure science and its practical application, and be enabled by this knowledge to form a true reason from cause to effect. Here he can become imbued with that inspiration to independency of thought which will enable his mind to develop unhampered by the trammels which are so apt to cling to and fetter it in the classroom.

Above all things, a course of engineering should never be allowed to degenerate into a formal course of training on the didactical system adopted in classical instruction, for, as has been remarked by Professor Tait, "It is better to have a rough climb—even cutting one's steps here and there—than to ascend the dreary monotony of a marble staircase or a well made ladder. Royal roads to knowledge reach only the particular locality aimed at—and there are no views by the way. It is not on them that pioneers are trained for the exploration of unknown regions."

So much for those who are intended to take positions of trust, and for those whose ambitions prompt them to qualify themselves for such positions when the chance offers. But for the great mass of workmen who form the rank and file the matter of technical education forms a much more complex question, and one to which it would be far more difficult to ensure a happy solution. Many are the conflicting opinions which exist upon this question; but although the various ideas upon the proper method which it is desirable to pursue to bring about the desired improvement are mostly very widely divergent, it seems to be pretty generally agreed upon that the higher education of the working man is the one and only panacea for the existing evils, and the one thing wanting to enable this country to compete triumphantly with the ever-growing foreign competition.

It seems, indeed, to be a generally accepted theory that it is the superior technical education of the foreign workman which has enabled the successful competition to be made with this country by other nations, but we think that a careful comparison would not show any such superiority, but rather that, if anything, the contrary is the case, and that such successful competition would be found to be due more to the better commercial education of their business men than to any special scientific training of their workmen. Commercial education teaches them how to sell in foreign markets. Nowadays it is, in fact, everything, and it is beyond all question the prime necessity of this country. In Germany we find a systematic organization and training of the young men for foreign service, and their consular service is being extensively reformed and is being thoroughly brought up to the requirements of the present day. Attention, though tardily, is being called here to these facts, and in a most interesting and instructive address delivered by Professor Flux, at the opening meeting of the Owens College on the third of October, there is much which should prove valuable reading to those concerned in these matters.

To revert, however, to the value of technological instruction for the workman. This we hold is a matter that requires far more careful consideration than it seems usually to obtain, and furthermore to be one which should be dealt with with the utmost caution, otherwise an imminent risk is run of producing a hybrid variety of man with a smattering of science which will make him think himself too good for his job, whilst he has an almost utter want of the manual dexterity which would make him a competent workman. Already the efforts of educational cranks and faddists are bearing fruit in this direction, and there are many men now calling themselves mechanics who are almost totally wanting in manual training in their business, and who are totally incapable of practically carrying out any specified piece of work.

As a matter of fact, life is not long enough to enable the average man to thoroughly master the practical details of a trade, and, at the same time, to obtain a sound knowledge of its theoretical aspect. To be a good handicraftsman little or no book learning is required, if he can read, write and cipher fairly, and is capable of reading a drawing, and, if necessary, doing a little drawing himself, it will be all that he will require, all of which could be easily learned at evening continuation schools whilst serving his time as an apprentice. Should he have the inclination, and the ability, to go further afield into the realms of science, any knowledge that he may acquire may help him to step from his place amongst the ranks, and tend, more or less, to fit him for a higher position, but, as a workman, it will be absolutely useless to him. To one man in a thousand, given certain chances, it may prove of benefit, provided he is in other ways fitted to seize upon the golden opportunity, when it comes, if come it ever does. To the other nine hundred and ninety-nine it is likely to prove a curse, rendering them dissatisfied with their positions and incapable of taking the intelligent interest in their daily work which they otherwise would have done.

All of us who can carry back our memories to the time when serving an apprenticeship, a quarter of a century back, will be able to call to mind the mechanic who, given a hammer, a chisel and a file, could do almost anything; whose fertility of resource and ready mechanical genius enabled him to overcome all obstacles—a skilled workman who commanded the respect of all who came in contact with him. Are such men likely to be found amongst those trained in technical schools? We think not.

In the first of the two lectures, of which Mr. Ruskin's little book, entitled "Sesame and Lilies" is composed, he makes the statement that "the English nation despises science, despises literature, despises art, despises nature, despises humanity." The latter count we are at the present time doing our best to prove the justice of for the benefit of the few and to the injury of the many. To the first accusation we do not think that the English nation ever laid itself open. In no country has science been more highly esteemed; in no country has the scientist received a fuller meed of reward for his labors than in this. But whilst always ready to honor true scientific attainments in the past, as in the present time, we have been above all things practical. It has been this combination of science and practice which raised this country to the position of the first manufacturing nation of the world, and if we are not able to maintain that position it is not that our workmen are less skillful or their leaders less scientific than those of foreign nations, but because, whilst all else has advanced, our commercial element has remained stagnant, and has persistently refused to grasp the fact that, with the keener competition of the present times, concessions must be made to the tastes and requirements of buyers, who, after all, when one comes to think of it, are justified in endeavoring to obtain what they want for their money, and in refusing to have forced upon them what the English manufacturer thinks they should require, and for which, furthermore, he opines they should be content to wait his pleasure. If this is not so, then we would ask how it is that the same workman, the same foreman, the same manager, transported to the United States, can succeed, whilst they fail here; nay, how is it that American methods instituted in this country with British rank and file can command success?

BRITISH NOTES.

[*From our own correspondent.*]

With the war in progress it is difficult to sit down calmly to write upon such a comparatively tame topic as electricity. Still, I take comfort in the circumstance that you and yours are scarcely less interested in our efforts to put down the intolerable state of things in South Africa than we are ourselves. Both as our kinsmen and as level-headed men of business your interest in this gallant struggle is only second to our own. So I take it that you will not be severe with me if my chronicle of our electrical progress falls somewhat flat this week.

I spoke of the war. Well, it seems that wireless telegraphy is really going to be given a chance under service conditions. It is a thousand pities that the authorities at the War Office did not think of it sooner and have the apparatus on the spot, ready for emergencies long ago. Had they done so we might have been kept better posted in the condition of our isolated garrisons at Mafeking and Kimberley. But it has been well said that the leopard can't be made to change his spots, and the day that the British nation found itself embarked in a war for which all possible preparation had been made, it would be felt that there was something very wrong indeed, that the national spirit had changed, and that for the worse. Unreadiness is the key-note of British officialism. After a reverse or two we generally contrive to pull ourselves together, but it really seems as if a reverse was a necessary factor in the situation.

A big tramway scheme has been put forward for Surrey and South London by the Surrey County Council. I forget whether I have mentioned it to you already, but if I should have done so, the importance of the subject must be my excuse for recurring to it. It is really the first attempt to apply your electric light railway system in this country, and the experiment will be watched with interest. This installment will cover most of the ground to some fourteen miles south of London. Wimbledon will be included, and Mitcham and Carshalton—in fact, the beautiful valley of the Wandle, which Ruskin has made so famous in your country as in ours—and Sutton, which lies on the lower slopes of the North Downs, most of them pretty country villages within my recollection, now, doubtless, to be engulfed within "the great wen," as Dulwich and Herne Hill and a thousand rural spots have been before them. You will understand that I am not denying the abstract propriety—even the necessity—of this step; people must, I suppose, have wherein to live, and the badness of our suburban railway service compels them to live nearer their office than is, I believe, the case in your country, but the loveliness of Surrey has always been admitted to be unique, and one can not witness its destruction quite unmoved.

The dangers of gas have been demonstrated yet again by a terrible explosion at Manchester, in which several lives, including that of the manager, have been lost. How it is possible for folks to continue to have this dangerous explosive laid on all their houses, especially when you recollect the ineradicable tendency that exists in our poor fallen nature to seek for gas leakages, when they are suspected, with a lighted candle, I have never been able to understand, and I never expect to do so. In electric light you have an excellent illuminant, cheap and practically innocuous, and yet we fool around with Welsbach burners and the like, while a large class of writers earn large incomes by demonstrating the superior merits of gas, both for cheapness and for illumination. I can quote no statistics of people killed by gas explosions and poisoned by gas escapes, but I am persuaded that such statistics, were it possible to get them, would startle the intelligent taxpayer considerably. It will be a serious matter for some of these literary Ananiases when they are called upon to encounter the throng of their victims in the next world.

Two large electricity supply stations have been inaugurated during the last few days. The great installation at Edinburgh has long been admitted to be one of the most successful in the country, and provision was made from the outset for a large excess in the demand over the requirements, even when estimated on a liberal scale. The wisdom of this policy has been more than justified. The demand has increased "by leaps and bounds," and the resources of the original station have been exhausted, insomuch that a new central station has become an absolute necessity. This has now been opened with all due pomp and ceremony. The new station in McDonald road will, when finally completed, contain about 30,000 horse-power, and will be worked in parallel with that in Dewar place, one of them being shut down during the periods of light load. One will thus always be in readiness as a reserve in case of fire or other accident. The increase in the number of lamps connected during the past year was 68,000—a startling figure, which amply justifies the construction of the new station. Professor Kennedy has been the consulting engineer from the inception of the undertaking. The other station to be inaugurated was that at Perth in the highlands of Scotland, though in this case the proceedings did not extend beyond the cutting of the first sod. Mr. Hawtayne, the engineer to this undertaking, has scored an initial success, inasmuch as the contracts have been accepted at a figure considerably lower than his original estimate, a circumstance which can not fail to appeal to the canny Scotch mind. It is intended that Perth shall be the best lighted city in the kingdom, and arc lamps will be placed in every street, instead of in a favored spot or two, as is so frequently the case in town installations, while the rest of the work is relegated to the comparatively feeble incandescent lamp. One of the speakers rightly laid considerable stress upon the future in store for electric power for motor purposes—a subject which has only been taken up comparatively recently, and has not received the attention which is its due, or anything like it.

Talking of the applications of electric power, I see that the Admiralty have lately been putting down extensive electrical plant for the Armor Plate Departments at Portsmouth, Devonport, Pembroke and Chatham Dockyards, while one of the inventors of the new process has been sent to Malta to arrange for a similar installation there. Details of the process are rightly not made public, but it is certain that it materially increases the speed at which the construction of new warships and the repairs of old ones can be effected. At a time when our excessively disagreeable neighbor across the Channel is outdoing herself in her expressions of vicious ill-will towards our long-suffering selves, you will understand the necessity of being prepared for every possible eventuality.

Did I ever tell you that the authorities in India are really awaking to the possibilities of generating electrical power afforded by their magnificent waterfalls and rivers, which are allowed to run to waste year by year? I suppose that for this, as for most other original suggestions in these days, we have to thank yourselves. However, it has, at length, been definitely decided to "harness" the sacred Narbada at the Marble Rocks to run the new gun-carriage factory at Jabalpur, while some 500 miles to the south an enterprising Canadian officer of the Royal Engineers, Captain de Lotbiniere, has been trying to persuade the authorities to make the great Kaveri Falls do something for their living by supplying power to the Kolar goldfields. At Simla and in Kashmir it is proposed to run two light railways by electricity obtained from hydraulic power. A pompous ignoramus who lays down the law with sublime confidence week by week in the columns of *Lightning*, tried to explain to an astonished world not long ago that it was the intention to run the Jabalpur works by power from the Godaveri, which is some 800 miles distant from Jabalpur, with a substantial mountain range between the two. Poor "Meteor" is a sad instance of the schoolmaster abroad.

London, November 3.

Where the Nickels Go.

In an address issued last week to its employés, President Vreeland, of the Metropolitan Street Railway Company, said: "To bring within the understanding of every one just how each five-cent piece you men collect is divided, I have made the following analysis from the company's records, to show where we stand with the capitalists who own the property we operate:

Labor	.0195
Material	.0048½
Taxes	.0026½
Interest	.0144
Total	.0414
Stockholders	.0086
Total	.0500

"That less than seven-eighths of one cent out of every fare goes to the stockholders will be interesting to the many who continually discuss the railroad business as one where there is nothing but income to embarrass the management.

"Out of every dollar spent in operating the Metropolitan system, eighty cents goes for wages and only twenty cents for material."

New York State Contractors' Association.

A meeting of the New York State Electrical Contractors' Association was held at Troy, N. Y., on November 14.

Some New Electrical Measuring Instruments.

The illustrations herewith show a variety of new electrical measuring instruments which have been recently introduced. Fig. 1 shows a type of direct-reading wattmeter for direct or alternating current. It is of the dynamometer type and is a zero instrument, the pointer attached to the milled head in the centre of the apparatus being moved around the scale until the index, shown in the upper part of the illustration, moves to the zero position. The dynamometer principle renders the indications of the instrument independent of frequency, wave form or power factor, its readings being always in true watts. It is intended to be used, like other portable instruments, lying on a table or shelf in an approximately level position. The scale is made to read from zero up to 60 kilowatts through various ranges, and it is made for a maximum voltage of 150 volts. For higher pressures a multiplying resistance must be used in the tension circuit.

Fig. 2.

Fig. 3.

Fig. 1.

Fig. 4.

Some New Electrical Measuring Instruments.

Fig. 2 shows a very interesting little instrument which is useful as a milammeter or as a very low-reading voltmeter. The scales are made to read from zero to 15 volts or less, and in current between 150 milamperes and 5. Double scale instruments are made, reading from zero to 5 volts and also from zero to 150 milamperes on adjoining scales. The apparatus is about the size and shape of a watch, and is provided with cords and terminals which can be screwed into the binding-post studs.

Fig. 3 shows a compact, small switchboard voltmeter or ammeter made especially for marine and yacht purposes. It is only seven inches high over all.

In Fig. 4 is shown an interesting series transformer arrangement for use with ammeters. The primary of the transformer consists of a single loop in a large copper bar, inside of which is its secondary of many turns multiplying the fall of potential across it, and to this is connected the ammeter as shown in the illustration. These are now being built for capacities up to 20,000 amperes.

All the above instruments are made by the Whitney Electrical Instrument Company, of Penacook, N. H., for which Messrs. Machado & Roller, New York, are the general sales agents.

The Cable Route to Manila.

The work of the collier Nero in surveying a route for a trans-Pacific telegraph cable between Honolulu and the Philippines is mentioned by Rear Admiral Bradford in his annual report. After a careful consideration of the subject it was decided that the route westward from Honolulu to the Philippine Islands was by way of the Midway Islands and Guam, landing the cable at a convenient point on the east coast of Luzon, as near as possible to the latitude of Manila. It was also decided as desirable to survey a route from Guam to Yokohama.

Two offsets from the projected great circle route between the Midway Islands and Guam were found to be necessary in order to avoid obstacles to a successful laying and operation of a telegraph cable. The first of these obstacles encountered is a submarine mountain, situated a short distance westward from the Midway Islands and rising from the bottom of the ocean, which here sinks to a depth of 2,200 fathoms, to within eighty-two fathoms of the surface. The second obstacle is one of the deepest submarine abysses yet found in the world, situated about 500 miles eastward of Guam and sinking to a depth of more than 4,900 fathoms. Reports have been received of the preliminary line of soundings from Honolulu to Luzon, and they indicate that the route which is being surveyed will prove entirely practicable.

Wall Street and the Electrical Stock Market.

The stock market for the week just closed witnessed more general speculative liquidation than for a very long time. This was due principally to the high rates for money on call and the fact that many brokers have notified their customers that they will not carry stocks at the old rates of interest. The higher-class investment securities have not been disturbed by the variations in the money market. A fairly steady contraction in prices, with substantially lower market valuations, was another feature of the week.

On the New York Stock Exchange General Electric closed the week at 122 bid and 122½ asked, a loss of ½ point for the week. Metropolitan Street Railway, of New York, closed at 192½ bid and 193 asked, a loss of 3¼ points for the week. Third Avenue Railroad, of New York, closed at 146½ bid and 150 asked, a loss of 7 points for the week. Brooklyn Rapid Transit closed at 85⅞ bid and 86 asked, a loss of 2¼ points for the week.

On the Boston exchange American Bell Telephone closed at 352 bid and 355 asked, a loss of 15 points for the week. Erie Telephone closed at 108 bid and 109 asked, a loss of 8 points for the week.

On the Philadelphia exchange Electric Storage Battery closed at 120 bid and no asked price. Union Traction closed at 38⅛ bid and 38⅜ asked, a loss of ⅛ of a point for the week. Electric Company of America dropped to 13½ during the week and closed at 14.

On the curb or outside market in New York Electric Vehicle closed at 67 bid and 74 asked, a loss of 3 points in the bid price for the week.

Electric Boat closed at 22 bid and 25 asked, a gain of 4 points for the week.

Wall Street, November 11.

BOOK REVIEWS.

"Construction and Repair of Commutators." By L. C. Sharp. Twenty-nine pages, fourteen illustrations. L. C. Sharp, Omaha, Neb., publisher.

A practical book by a practical man on a practical subject. It is the sort of book of which there ought to be many more, being to the point, plainly written and easy to understand, and telling the mechanic, who wishes to understand commutators, exactly the things he needs to know without burdening him with unnecessary details. It is an admirable little book.

"Fowler's Mechanical Engineers' Pocket-Book." Edition of 1900. The Scientific Publishing Company, Manchester, England.

This excellent work is too well known to require an extended review. The new edition has been brought up to date in several particulars, typographical errors having been corrected and especial attention being paid to tables dealing with high-pressure steam phenomena. The book is not truly a pocket-book, being about an inch and a quarter thick, principally by reason of a large number of advertising pages contained in it.

A Trolley Car Held Up on Long Island.

A trolley car was held up in a lonely part of Glendale, L. I., by four highwaymen early on Sunday morning last. The men were armed, and it is thought they expected to get considerable money from belated passengers. However, the car was empty, and only $8 in money and two silver watches were secured from the motorman and conductor. The latter were taken off the car and sent into the woods, while the highwaymen got aboard the car and ran it some distance up the line. Later, the motorman and the conductor were rescued by a sand car, and the trolley car was recovered further up the road.

The Delaware Valley & Kingston (N. Y.) Railway Company, with a capital of $2,500,000, has been incorporated. It will be operated by electricity, and will be about eighty-one miles in length, with termini at Kingston, Ulster County, and a point in Sullivan County on the boundary line between New York and Pennsylvania, opposite the borough of Lackawaxen, Pike County, Pa. The railroad will run through Ulster, Orange and Sullivan counties. The officers of the company are: President, William V. S. Thorne; secretary and treasurer, George H. Church, and chief engineer, Charles E. Webster. Of the capital stock, $250,000 has been paid in in cash.

Telephone News .....and Comment

Saratoga, Wyo., will soon be in direct communication with Salt Lake and Ogden and Denver and other Colorado towns, over a long-distance telephone line.

The Duluth (Minn.) Telephone Company has had plans prepared for a new exchange building to be erected on West First street, at a cost of $50.-000.

The towns of Warren (Minn.), Argyle, Stephen and Hallock are agitating the question of putting in a long-distance telephone. All of them, except Stephen, have a home exchange telephone system.

N. B. Cooley, H. O. Miller and A. G. Lupton, owners of the Hartford City, Ind., telephone exchange, have purchased the telephone system of the Montpelier Telephone Company, and will operate it in connection with the local plant.

A new telephone line is to be erected, running from Hunlock Creek, Pa., to Sweet Valley, by way of Prichard, returning by way of Muhlenburg and, possibly, Irish Lane. The prime movers in it are Dr. C. A. Long, G. W. Callender, W. W. Prichard, A. T. Dymond and Ray Van Horn.

The People's Telephone Company, of Ontario County, N. Y., with a capital stock of $8,000, has been incorporated. The lines of this company are intended to connect Naples with Canandaigua, Holcomb, Honeoye, Hemlock and the intermediate points in Ontario County. The directors are Hector W. Blake, George R. Granby and Frank W. James, of Naples; John Ricketson, of Bristol Springs; Mark A. Case, of Bristol Centre; Frank A. Jones, of Holcomb, and William H. Doyle, of Bristol.

West Point, Neb., is now connected with Omaha by a single-direct telephone wire, which obviates the necessity of having to make connections at Fremont. The Nebraska Telephone Company is extending its line from West Point to the country districts west of the city. A line is being run to the St. Charles settlement and thence to the village of Monterey. This improvement will place West Point in direct telephonic communication with the richest and most populous portion of Cuming County.

Owing to the serious illness of Mr. C. C. Bulkley, attorney for the complainant, the final hearing in the Court of Appeals, at Washington, of the suit of Frank B. Cook against the Western Electric Company for infringement on a patent on telephone and switchboard protectors, has been postponed from the November to the January term. It is understood that Mr. Cook, who is now president of the Sterling Electric Company, Chicago, will turn his attention to other violators of his patent rights as soon as the decision in the above case has been rendered. His claims have already been upheld three times in the lower courts.

ELECTRIC RAILWAY NOTES.

The consolidated Traction Company, of Pittsburgh, has declared the regular semi-annual dividend of three per cent on its preferred stock, payable November 15.

It is said that the Marlboro (Mass.) Street Railway Company has purchased the Union Street Railway, of Framingham. The two roads are connected at Framingham by a junction of their tracks.

The directors of the Palmer & Monson (Mass.) Street Railway have organized with Charles F. Grosvenor, president; E. G. Hastings, vice-president; Andrew Pinney, clerk, and P. H. Hampton, of New York, treasurer.

The Pittsburgh (Pa.) Electric Railroad Company has filed articles of incorporation. The capital stock of the company is $125,000. The directors are Morris Cliggitt, F. B Wheeler, A. O. Blair, G. W. Williams and J. A. Nutman, all of Pittsburgh.

At a meeting of the Board of Highway Commissioners, permission was granted to the Saratoga (N. Y.) Traction Company to construct, maintain, use and operate a street surface railroad for public use along and across the surface of the highway leading from Eddy's Corners to Saratoga Lake.

The Fredonia (N. Y.) & Lilydale Electric Railroad Company has been incorporated, with a capital stock of $150,000, to build from Fredonia to and through the assembly grounds at Lilydale, about seven miles. C. V. Boughton and A. Schmidt, Jr., of Buffalo, and W. W. Cole, Elmira, N. Y., are incorporators.

The Youngstown (Ohio) & Sharon Railroad Company has been incorporated, with $200,000 capital. The company will build an electric railway from Youngstown, through Hubbard in Trumbull County, to Sharon at the Pennsylvania line. The incorporaters are John C. Whittle, F. N. Patterson, B. F. Wirt and others.

The Duquesne Traction Company, of Pittsburgh, Pa., has just declared its regular semi-annual dividend of two per cent, or $1 per share. The company is leased to the Consolidated Traction Company for a guaranteed rental of $125,000, or four per cent per annum on its capital stock of $3,000,000. The last sale of the stock was at 45. The bonds of the company are selling around 112.

At the annual meeting of the East Wareham (Mass.), Onset Bay & Point Independence Street Railway Company the following officers were elected: President, Joseph K. Nye, of Fairhaven; vice-president, William F. Nye, of Fairhaven; clerk and treasurer, Andersen W. Kelley, of Fairhaven; superintendent, F. L. Benson, of Onset; directors, the above, and Captain B. F. Gibbs, of Onset.

At a meeting of the stockholders of the Wakefield & Stoneham (Mass.), Mystic Valley, Reading & Woburn, Reading & Lowell and Salem & Wakefield street railway corporations the following were elected directors in all five corporations: P. F. Sullivan, of Lowell; J. H. Goodspeed, of Boston; E. C. Foster, of Lynn; Charles Williams, of Wakefield, and Mr. Stone, of Lynn. Charles F. Woodward, Ezra M. Southworth and J. Wallace Grace resigned as directors.

The Brooklyn (N. Y.) Rapid Transit Company has announced that it will shortly begin the operation of elevated railroad trains over the trolley road of the West End route to Coney Island. The route is through Borough Park, Blytheburne, Van Pelt Manor, Bath Beach and Bensonhurst. The company will also reopen the old route from New Utrecht and Ninth avenue into the Union Station at Fifth avenue and Thirty-sixth street, and a connection between the elevated and surface roads will be made at this place.

ELECTRIC LIGHT FLASHES.

The Sumter (N. C.) Electric Light and Ice Company has been incorporated, with a capital of $25,000, by Robert M. Wallace, Charles T. Mason and B. O. Purdy.

The Edison Electric Illuminating Company, of Boston, has been authorized by the Gas and Electric Light Commissioners to issue 4,000 shares of stock to be offered stockholders at $175.

The Ceramic City Light Company, East Liverpool, Ohio, has been incorporated; capital, $200,000; incorporators, L. W. Healy, J. H. Brooks, F. H. Croxall, G. O. Anderson, H. H. Blythe.

The Manhattan Light and Heat Company, with an authorized capital of $8,000,000, has been incorporated to furnish light and heat in New York, and specially to use new patent burners. The corporators are Frank M. Wirgman, George Myers, Jr., and George H. B. Martin, all of Camden, N. J.

Calumet, Mich., capitalists are organizing a stock company to erect an electric lighting plant at Lake View, a mile from the city, and purpose to furnish lights for business houses and residences in Calumet, Red Jacket and Laurium. They intend to run an underground system of wiring from the plant to the city.

Mrs. Katherine Mackey, who recently purchased Harbor Hill at Roslyn, L. I., for a country home, has made another purchase of land in that vicinity. It includes an old mill and a waterway. This mill will be used to house an electrical plant operated by water-power, which will supply light and power for Mrs. Mackey's house.

The lighting plant of the old Kearney (Neb.) Electric Company and all its equipments has been purchased by F. W. Blees, of Macon, Mo.; Charles Roehl, of St. Joseph, Mo., and J. F. Schaefer, of Kansas City. The new company will be called the Northwestern Electric Heat and Power Company, and F. W. Blees will be the president. J. A. Clarey, of Kearney, will have charge of the plant.

Stockholders of the Boston Electric Light Company have been notified that the stock of the company has been increased from $2,500,000 to $3,000,000 by the addition of 5,000 new shares. Each stockholder is entitled to subscribe for one new share for every five shares of old stock standing in his name August 8, 1899, paying therefor $150 per share. Subscriptions, which must be for full shares, must be filed by November 15, and payment must be made on or before January 10, 1900. New stock will be issued on the latter date. "Rights" may be purchased or assigned. All new shares will participate in the dividend payable April 15, 1900. Shares not subscribed for November 15 will be sold by public auction.

ARC LIGHTS IN THE DRAFTING ROOM.

BY G. F. GEBHARDT IN THE "AMERICAN MACHINIST."

The artificial lighting of the drafting rooms of commercial and educational institutions has always been a perplexing problem. In the case of educational institutions the problem is of serious importance, especially in the higher departments of machine design, where the student is compelled to devote four or five hours a day to the analysis of complex mechanisms with minute exactness. Particularly during the Winter, when artificial lighting is necessary the greater part of the day, poor lighting is manifestly deleterious and very apt to cause permanent injury to the eyes. Poor lighting does not necessarily imply a deficiency of light; on the contrary, the opposite is usually the case. Take, for example, the common practice of suspending a 16-candle-power incandescent lamp directly over the work. Here the light is too direct, reflecting a dazzling glare from the paper, and casting deep, annoying shadows. It also lacks penetration, as is particularly noticeable when using tracing cloth; 32-candle-power lamps with frosted bulbs mitigate the evil to some extent, but fail to meet the requirements of a perfect light. The heat of the lamp is also disagreeable, causing dull pains in the head after continuous use, and often incapacitating the student for further work.

In the lighting of the main drafting room of the Armour Institute of Technology, Chicago, Ill., the problem was unusually perplexing on account of the capacious dimensions of that room, 55 by 55 by 25 feet, and on account of the great number of drafting tables therein contained, 104 standard tables, each 36 by 42 inches; besides, the surrounding woodwork was to be left in its natural dull color. The first system consisted of suspending a network of moulding, etc., several feet above the tops of the desks, so that each table might have its own 16-candle-power incandescent lamp, pendent, with adjustable flexible wire cord, and fitted with separate rosettes or fuse plugs. Branch blocks were also used with each row of lights to localize the evil effects of possible short-circuiting. The advantages of this system are obviously the facility with which the necessary lights are brought into use and the consequent resulting economy in power. This system was used for some years and proved unsatisfactory, for reasons inherent in incandescent practice, as stated above, and because the overhead network, in addition to its unsightliness, became a harbor for dust, which persistently deposited itself upon the drawings. The use of 32-candle-power frosted-bulb lamps would have been a material improvement, but was impracticable, as 104 amperes would have proven an unwieldy and dangerous current for the light, exposed woodwork.

The present system of arc lights was installed this Fall, and is a marked improvement over the old one. Nine 1,200-candle-power enclosed arc lamps with opal globes and reflectors, one lamp for every 120 square feet of desk surface, are suspended from overhead girders and distributed symmetrically throughout the room. These lamps are connected in parallel and burn with an arc of 80 volts and current of 5 amperes on a circuit of 120 volts, direct current. They burn 130 hours before renewal of carbons is necessary. The drafting tables are arranged in groups so that the lamps may hang over the aisles, and so that each light may dissipate the shadows of the others. The height of each lamp is adjustable, but experience has shown that a common distance of 7 feet above the tops of the tables gives the best results.

Single lamps occasionally become unsteady when regulating, but the evil therefrom is almost entirely overcome by the lights of the others. The light, *in toto*, is soft and diffused, yet powerful; it is satisfactorily steady, has great penetration and is remarkably free from deep shadows. The heat is also imperceptible. The students are able to work much longer in this light without fatigue, and in no instance have they experienced any deleterious effects. The only objection to this system lies in the extravagance of power due to the inability to regulate the amount of light in proportion to the number of students. As it is, a few scattering students use as much light as a full quota.

Experiments conducted with the use of both arc and incandescent lamps gave varying results, but proved beyond a doubt that one or more arc lamps judiciously placed will more than offset the increased cost of power with the increased value of the lights, toning down the high lights and softening the shadows to a great extent.

GROUP OF 2,500-HORSE-POWER TRANSFORMERS.

The success of the present system is entirely due to the use of a number of arc lamps, as each is able to modify to some extent the shadows of the others, and thus conjointly produce a soft and diffused, yet powerful, light.

The Largest Transformers in the World.

A contract has recently been closed between the Cataract Company and the Union Carbide Company, both of Niagara Falls, calling for the former to furnish the latter (on the latter's premises) with 15,000 horse-power at 2,200 volts. It was found that the copper necessary to transmit this amount of energy, at the generator voltage of 2,200, would cost several hundred thousand dollars, though the distance is only 2½ miles. It was then decided to use high-tension transmission, and bids were called for from various companies to supply the necessary transformers to transmit the energy at a potential of 11,000 volts. A contract was closed with the General Electric Company to furnish 15,000 horse-power transformer capacity, which proves to be cheaper than the increased cost of copper necessary to transmit at the lower voltage. This fact points to the great advantage of high-potential transmission even for short distances.

The General Electric Company are furnishing seven transformers of 2,500 horse-power capacity each, working at a frequency of 25 cycles, a primary pressure of 11,000 and a secondary of 2,200 volts. These transformers are by far the largest that have ever been built, the next size smaller being only one-half their capacity; namely, 1,250 horse-power.

The total weight of each transformer is 50,000 pounds. This is a good load for a freight car, so that a train of seven cars would be necessary for the transportation of the total order. About 12½ tons of sheet-iron are used in the cores. The coils of the transformers are 6½ feet long by 4 feet wide, or about the size of an ordinary billiard table.

The clamps for holding the sheet-iron core together weigh approximately 4,000 pounds, and a steel bar 4½ inches in diameter and nearly 4 feet long is used for a support when raising the apparatus. Even with this large steel bar it is necessary to use a space block that will keep a sling in such a position that the strain will come on the bar near the points of support.

The complete transformer is 11 feet 1¼ inches high, 8 feet 7½ inches wide and 4 feet 4½ inches deep. It can not be shipped entirely assembled, as the height is too great to pass under railway bridges

Tests of these transformers are stated to give the following results:

Iron loss	22,600	watts.
Copper loss	8,700	"
Regulation	½	per cent.
Efficiency, full load.	98.3	"
" ¾ "	98	"
" ½ "	97.3	"
" ¼ "	95.3	"
Rise in temperature after eight hours at full load is	45	degrees C.

The transformers will run at full power continuously, so that the copper loss was favored rather than core loss.

The instruments are cooled by use of both water and oil, 650 feet of piping being necessary for each. At an efficiency of 98.3 per cent it would seem at first sight that the radiation of heat, due to the losses, would be a small matter. But 1.7 per cent of 2,500 horse-power amounts to over 40 horse-power, or enough energy to supply six hundred 16-candle-power incandescent lamps. The accompanying illustration shows five of the transformers which are already installed.

Rubber in the Philippines.

As a sound and promising investment for American capital it would be difficult to find any industry in the Philippines that could beat the cultivation of the rubber plant, says a Washington paper. Indeed, with proper time and attention devoted to it, investors are bound to make the pleasing discovery that the land has not as yet given forth any product that can vie in rapid yield and heavy profits with rubber.

The ficus elastica is a native of nearly all tropic or sub-tropic climes, and it is to be met with in some form or other throughout the greater part of the Island of Luzon, and even more plentifully in Mindanao and the southern islands of the group. But the genus ficus elastica comprises many species, some of which would hardly pay for cultivation, while others would yield a profit of between 300 and 400 per cent. Of the profitable species two or three are native to Philippine soil, while the others could without difficulty be imported in seed or as graftings from other and not very remote parts. The beauty of the rubber plant is that the seeds or graftings contain an enormous latent energy. So much that after a month or two of reasonable care and precautions they require no further nursing, and will not only hold their own, but even in their vigorous upshooting drive all other growths within reach out of the soil.

The method of planting is simple in the extreme, the season for it being preferably shortly before or even during the rains. The great secret lies in the time and mode of tapping the juice, for on it depends not only the success of a particular crop, but also the very life of the tree. Properly attended to, there can be no prettier sight than a flourishing rubber plantation, with its rows of regularly set trees with graceful, drooping branches, bearing foliage of a vivid and cool shade of green, with bunches of pretty, olivelike seedlings hanging here and there like festoons.

Whether rubber pays is a question that no man at all conversant with the European or American markets will ask. A rubber famine is a possibility not at all so remote, after the wanton manner in which forests of trees containing the precious sap have been destroyed, on the proverbial principle of killing the goose that lays the golden eggs, and prices are constantly rising, and the supply is lagging wofully behind the demand for the thousand and one purposes to which rubber is put nowadays. The introduction of the automobile and the greatly increased manufacturing of bicycle and various other vehicle tires have done much toward creating an extraordinary demand and consequent advance in prices for rubber on account of its comparative scarcity.

The plant and machinery requisite for rubber growing are of the simplest description, the initial outlay is not great, and long within the second year of planting a tree will commence to yield a profitable return, and for several consecutive seasons will give constantly increasing returns.

A New Lamp Catalogue.

The Western Electric Company, Chicago, has just issued a new catalogue on "Sunbeam" incandescent lamps. The illustrations, which are many and handsome, are made direct from photographs. The Western Electric Company has the exclusive agency for the "Sunbeam" lamps. Considerable work has been done during the last year in the lamp factory, and the most modern machinery and methods are employed in manufacturing. A complete new type has been developed and the styles are shown in the illustrations in the catalogue.

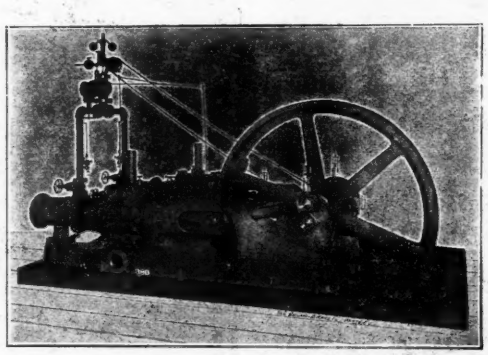
A Substitute for Sal Ammoniac.

There are many reasons why sal ammoniac is not an entirely satisfactory electrolyte for use in primary batteries. The products of the solution of zinc in the various acids of the chlorine group which are formed by its decomposition are mostly insoluble, and clog the surface of the carbon, remain on the surface of the zinc and lessen its available area, and, where porous cups are used, soon render these useless. The solution of the salt in water also produces a considerable degree of cold, causing moisture to condense on the jar and facilitating the creeping of crystallized salts upon it. A new substance known as Federal salt, which is made by the Federal Battery Company, of New York, is said to give a higher electro-motive force and to obviate the difficulties enumerated above. The solution contains a depolarizing agent which is perfectly soluble, and it is stated that no insoluble matter is produced during the operation of the cell. As the salt is nearly used up the solution turns milky, giving a timely warning. It is said that the salt produces no creeping crystals, and its users speak highly in praise of it.

A Steam-Driven Air-Compressor.

The illustration represents a new type of air-compressor of the mechanically-operated inlet-valve variety. Air-compressors are coming into general use in many manufacturing establishments where compressed air is used for sand-blasting, cleaning castings, blowing furnaces, etc., and any new machinery of this type possesses, therefore, comparatively general interest. In the apparatus illustrated the inlet-valves are of a semi-rotating type and are worked from a wrist-plate. The discharge valves are of the poppet variety, and both the valves and their seats, as well as the springs which control them, are made of high-grade tool steel. The valves are so arranged that with their seats they can be readily removed for inspection through hand-holes placed over them for the purpose. It is stated by the makers, the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, that the noise usual in the operation of air-compressors has been practically eliminated in this new design.

The steam cylinders are out-board, and by taking them away the compressor can readily be changed to a belt-actuated type or arranged for direct coupling to an electric motor. The whole machine as it stands is self-contained, the bed-plate on which it is mounted carrying cross-heads and the bearings of the main shaft. The cylinders are connected to the bed by heavy cast-iron yokes, making the rod glands easily accessible.



A STEAM-DRIVEN AIR COMPRESSOR.

Electrical Engineering Theses at the University of Illinois.

The subjects for theses of the present senior class in the Department of Electrical Engineering of the University of Illinois, at Urbana, Ill., will include the following:

The Design and Construction of a Motor Generator.

Test of a Rotary Converter and Performance as a Synchronous Motor.

Design and Experimental Study of Transformers of Various Types and Windings.

Theoretical and Experimental Investigation of Induction Machines.

Design and Experimental Working of a Polyphase Transmission Line.

Many of these investigations will be made on new and especially designed equipment now being installed in the Electrical Engineering Laboratory of the University.

The Berliner Patent Suit.

Argument was heard in Boston last week in the suit of the Western Electric Company, on behalf of the American Bell Telephone Company, against the National and the Century Telephone companies. It was expected that the presentation of the case would be finished early this week, but the decision of the court may not be handed down for some time.

The patent in suit is that on the Berliner transmitter, which was issued November 17, 1891, after long delay in the Patent Office, and in consequence has yet nine years to live. It is No. 463,569, for a combined telegraph and telephone, and its owners claim that it covers all forms of microphone transmitters or contact telephones.

A Large Export Order.

The United States is taking its place as an exporting nation with great rapidity. One New York firm alone has recently taken contracts for about a half-million dollars worth of electrical apparatus and supplies for Cuba, Mexico and Portugal. This includes all the trolley feed and span wire for the lines of the Havana Electric Railway Company, 2,200 steel poles with iron-work fittings and 60 freight car loads of terra-cotta conduit. This is said to be the largest export order for wire ever filled in this country. A very large order for electric railway material for use in Mexico and Portugal is also being filled by the same concern. The lucky house is the Morris Electric Company, successor to Elmer P. Morris, of New York.

The Manufacture of Porcelain Insulators.

There are many steps in the process of manufacturing porcelain insulators for high-tension work which are of considerable interest. A new factory has been erected at Victor, N. Y., by Mr. Fred M. Locke, for this class of work, and contains the latest appliances used in connection with it. The building is a two-story structure of large size, the ground floor being taken up by sifting and mixing vats, moulding presses, where the water is squeezed out of the clay, and the great kiln, which occupies about one-third of the total building. The second floor is used alone for moulding, shaping and drying, the clay being prepared here for the burning. The peculiar style of insulators made in this factory consists of three separate bells which are burned together in the second heat when the glaze is put on. They are burned at a very high temperature and are vitrified

Fig. 1.

Fig. 2.

Fig. 3.

New Types of Porcelain Insulators.

throughout, increasing both their electrical and mechanical strength. Despite the fact that this factory can turn out 60,000 insulators a week, the increased use of porcelain on electric lines has already made the demand greater than can be met, and new buildings are in course of construction to enlarge the plant. The illustrations shown herewith represent several varieties of the high insulation products of this model plant. The street railway feeder insulator is of a peculiar design. It fits over a porcelain base which is mounted on a ⅝-inch high-carbon steel bolt. This runs through the extra heavy porcelain base which is designed to make a water-tight joint at its seat on top of the cross-arm. It is claimed that this arrangement does not weaken the cross-arm as the large holes necessary for wooden pins do, and also that the tight joint, which prevents the entrance of water, does not allow decay to begin around the pin. The grooves in the heads of these insulators are made to fit any size cable, either for attachment on top or at the side of the insulator.

Long-Distance Telephone Extensions.

On November 13 telephonic communication was opened between New York and Savannah, Georgia. The Mayor of the latter city, who was in New York at the time, spoke to a gathering of his constitutents over the wire. The American Telephone and Telegraph Company has lately opened new lines to Superior, Wis., and Mobile, Ala., and its lines at present extend from Augusta, Me., to Topeka, Kan.

New Telephone Company Temporarily Organized.

A temporary organization of the Telephone, Telegraph and Cable Company, of America, was effected at a meeting of the stockholders on November 13, in Jersey City. The charter was accepted and the following officers were elected: William J. Latta, president; George F. Hawkins, treasurer; John B. Stauffer, secretary. The incorporators are W. J. Latta, Martin Maloney and James E. Hayes, and they were elected to act as directors, others to be added.

Electric Company of America.

The Electric Company of America, which was recently incorporated with a $25,000,000 capital, of which $17,500,000 shares have been issued, has announced that it controls the following companies: Electric Light Company, of Camden, N. J.; Electric Light Company of Atlantic City, N. J.; Atlantic City (N. J.) Electric Light and Power Company, Jamaica (N. Y.) Electric Light Company, Edison Illuminating and Power Company and Electric Light and Power Company, of Long Island City, N. Y.; Scranton Illuminating Heat and Power Company, Suburban Electric Light Company (with the Columbus Colliery operated thereby) and Dunmore Electric Light, Heat and Power Company, all of Scranton, Pa.; Consumers' Electric Light Company, of Wheeling, W. Va.; Edison Electric Light Company, of Altoona, Pa.; Conshohocken Electric Light Company and Conshohocken Gas Light Company, of Conshohocken, Pa.

Comparison of the Gas and Steam Engine.

In a recent publication of a large manufacturer of both gas and steam engines in the United States, the question as to what is the comparative cost of operating a gas engine and a steam engine of equal power is discussed. The firm in question states that, considered solely as a machine for converting the total energy of the fuel into mechanical work, the gas engine is by far the more efficient. There are gas engines in operation which transform over 25 per cent of the heat in the fuel into useful work, while in the very best recorded performance of the steam engine barely 14 per cent of the energy in the coal burned has been thus accounted for. There are many small plants, consisting of common slide-valve engines, with uneconomical types of boilers, in which less than 2 per cent of the energy in the coal burned is converted into mechanical work. At the same time it must be remembered, says the *Mechanical Engineer*, that a given number of heat units in the form of fuel suitable for use in a gas engine costs more than an equal number in the shape of coal or other ordinary fuel suitable for burning in a common boiler furnace. As a general proposition it may be assumed that in a plant which operates continuously the item of fuel alone will be somewhat greater for the gas engine than for an approved type of modern steam engine, except possibly in the case of an engine running on producer gas. Where the service is of an intermittent nature, or the power is required only for a comparatively short time each day, this difference in favor of the steam engine becomes less, and may even become a balance in favor of the gas engine, for the reason that in the gas engine plant there are no "stand-by losses;" *i. e.*, radiation and leakage when standing idle under full steam pressure, and coal burned in banking fires and raising steam. With the gas engine the fuel expense starts and stops with the engine. But the fuel cost is only one item in the cost of producing power. One must consider the value of the additional space and buildings required for a boiler plant, the cost of a stack, labor of handling coal and ashes, cost of attendance, oil and water, depreciation, repairs and insurance on a boiler plant. The gas engine has a field of its own which can not be occupied by the steam engine, and there is no immediate prospect of the gas engine seriously encroaching on the legitimate field of the steam engine.

A New Air-Compressor Company.

Announcement has been made of the organization of the New York Air-Compressor Company under the laws of the state of New Jersey. The capital stock of the company is $100,000, and a complete foundry and machine shop plant has been purchased on the line of the New York & Greenwood Lake Railroad at Arlington, N. J. Contracts have already been let for a full modern equipment of tools. It is intended to manufacture a complete line of air-compressing machinery at the new plant. The officers of the company are J. W. Duntley, president; Alexander MacKay, vice-president; W. P. Pressinger, secretary and treasurer. The directors are J. W. Duntley, Alexander MacKay, W. P. Pressinger, William B. Albright, W. O. Duntley, Thomas Aldcorn and Austin E. Pressinger. The New York offices of the company are at 120 Liberty street.

Fort Wayne Traction Company.

The Fort Wayne, Ind., Traction Company has purchased the property of the Fort Wayne Consolidated Electric Railway at receiver's sale. J. H. Wade, of Cleveland, is president of the new company, and General George Garrettson, also of Cleveland, one of the prime movers. All the new owners are Cleveland men except J. H. Bass, of Fort Wayne. The capital stock is $2,000,000. The directors have authorized an issue of $1,500,000 bonds, and a mortgage to secure the bonds has been executed with the Guardian Trust Company, of Cleveland. The two years' receivership has been wound up and the sale of the property formally ratified by the court. The present management will probably continue.

A Large Order For Cable.

The National Conduit and Cable Company, Times Building, New York city, has received from the Third Avenue Railroad Company, of New York, an order for 150,000 feet of 1,500,000 circular mils lead-covered cable, to be used as feeders for the downtown section of the company's road, which is being changed over from cable traction to the underground conduit electric system. It is understood that the National company has agreed to make, deliver and install this cable at the rate of 6,000 feet per day. The Third Avenue company hopes to have its road running by electricity from the Post Office to the Harlem River not later than November 22.

ADVANCE INFORMATION

New Telephone and Telegraph Companies.

BURLINGTON, VT.—The New England Telephone and Telegraph Company have decided to make changes and improvements on the northern division of their line, including the rebuilding of several short lines.

WEST MILTON, OHIO—The Progress Telephone and Telegraph Company is extending its lines north from Pleasant Hill, north and south from Potsdam, and expects soon to build east from Troy and southeast from West Milton.

NEW YORK, N. Y.—The Brokers' District Telegraph Company has been incorporated; capital, $10,000; directors, Samuel M. Richardson, Henry D. Kuck and George H. Vandewalker, of New York city.

ST. LOUIS, MO.—The Mississippi Valley Telegraph Company has been incorporated; capital, $10,000; incorporators, J. Armstrong, P. J. Nolan, J. J. Murphy, L. F. Gates, T. E. Burke, all of St. Louis.

POINT MARION, PA.—The Springhill Electric Light and Power Company, to supply light, heat and power, has been incorporated; capital, $1,200; incorporators, A. S. Maple, O. A. Miller, both of Point Marion; F. S. Ruff, J. J. Quertimort, J. J. Mayer, all of Jeannette.

TRENTON, N. J.—The United Telephone and Telegraph Company has been incorporated; Alexander Brown, Henry A. Parr, T. J. Hayward, S. D. Warfield, James Bond, all of Baltimore, and John Haddon, of Jersey City, are the incorporators; the capital is $5,000,000.

FLORA, IND.—David E. Miller, manager of the Flora & Bringhurst Telephone Company, has been granted a franchise to construct and operate an exchange at this place. It is understood that the Miller lines will soon be connected with the lines of the new company, of Indianapolis.

PARMA, MICH.—The North Parma Telephone Company will soon have a line running into Concord township, as well as a line from Devereaux to this place, and will connect with the state line in this village.

GROVE CITY, MINN.—The Grove City & Rosendale Telephone Exchange Company has been incorporated, to conduct and operate telephone exchange; capital, $2,000; incorporators, B. Bresden, N. N. Waylander, A. Liedholm, of Grove City; M. P. Madison, L. P. Sorenson, H. P. Anderson, all of Rosendale.

LAMONT, ILL.—The Valley Telephone Company has been incorporated; capital, $10,000; incorporators, F. W. Welch, E. L. Husten, J. A. Freed, all of Chicago.

CECIL, WIS.—The long-distance telephone line, to extend from New London to Oconto, has reached this place. A central office outfit is now being put in. About four miles of wire is being put up daily. The line will be completed soon.

SUTTON, MASS.—Telephone communication with Millbury and other towns will soon be established, as the contract is made and signed.

WILMINGTON, DEL.—The Maryland Telephone Company has completed its line to Delaware, and will connect at Laurel with the Diamond State Telephone Company.

New Electric Railways.

CLEVELAND, OHIO—The Cleveland, Barberton & Western Railroad Company, of Barberton, capitalized at $250,000, has been incorporated by C. C. Benner, Forest Firestone, Edwin E. Voris, Wm. A Johnston and Philo Buel.

MILWAUKEE, WIS.—An electric company has been incorporated to build an electric line from Milwaukee to Muskegon Lake, a distance of 12 miles, by S. M. Williams, Fred W. Henderson and S. Henderson.

PORT CARBON, PA.—The Schuylkill Valley Street Railway Company has been incorporated, with a capital of $120,000, to build an electric street railway from this city to Tamaqua, Schuylkill County. Wm. M. Brewer, president, Pottsville, Pa.

WOOSTER, OHIO—The Barberton Doylestown & Massillon Electric Railway Company has been incorporated, with a capital of $50,000.

CUMBERLAND, MD.—A movement is on foot looking to the construction of an electric railway line, a mile in length, between Frostburg and Eckhart The Frostburg Electric Light Company and several other capitalists are said to be interested in the project.

CLEVELAND, OHIO—Eugene Rawdon, of Windsor, Ohio, has obtained franchises for 250 miles of electric railway to complete an electric railway system from this city to Pittsburgh, with branches to Titusville, Pa., and Edinborough, Pa., where it will connect with the rapid transit company. The franchises are for 50 and 99 years. It is estimated that $4,000,000 will be required to put the project through. Mr. Rawdon says the forming of the new company will be taken in hand by Philadelphia capitalists, to whom he will turn over the franchises.

SAN JOSE, CAL.—The Supervisors have recently granted A. Greeninger and associates the franchise for a standard electric road from the northern city limits to Alviso.

WILKESBARRE, PA.—The Wilkesbarre Street Railway Company has been incorporated; capital, $60,000; incorporators, M. B. Williams, W. Conyngham, J. N. Conyngham, A. A. Sterling, all of Wilkesbarre; A. G. Nesbitt, of Kingston.

DENVER, COLO.—The town of Victor, in the Cripple Creek district, has granted a franchise for terminals for a new electric short line to Colorado Springs. As the franchise covers all the streets in the camp, reports are current that other roads may also be negotiating for terminals in conjunction with the short line.

LOGANSPORT, IND.—The Logansport, Rochester & Northern Traction Company has received bids for constructing an electric line from this place to Kendallville.

WEST LIBERTY, PA.—The West Liberty Street Railway Company has been incorporated; capital, $12,000; incorporators, H. Moore, J. C. Fisher, J. S. McKelvey, all of Pittsburgh; A. C. Wettengel, of Elliott; G. Hook, Jr., of Bellevue.

Electric Light and Power.

TRENTON, N. J.—The Manhattan Light and Heat Company, with an authorized capital of $8,000,000, has been incorporated to furnish light and heat in New York, and especially to use the Loeben patent burners.

PORT MARION, PA.—The Springfield Electric Light Company has been incorporated, with a capital stock of $12,000.

PATERSON, N. J. — The Union Water, Light and Power Company has been incorporated. The capital stock is $1,000,000.

CALUMET, MICH. — Capitalists of this place are organizing a stock company to erect an electric lighting plant at the little town site of Lake View, a mile from the city, and purpose to furnish lights for business houses and residents in Calumet, Red Jacket and Laurium.

AUBURN, ILL.—The Auburn Electric Light Company has been incorporated, with a capital of $8,000; J. A. Wheeler, W. H. Ramsay and Geo. W. Hutton, incorporators.

DYSART, IOWA—The City Council of Dysart is now agitating the feasibility of putting in a gas plant for the purpose of lighting their city.

SHIPPENSBURG, PA.—Members of Town Council are talking of a new electric light plant for this borough.

DEGAFF, OHIO—The Council has called an election to vote on the question of issuing bonds to enlarge the electric light plant.

COOPER, TEX.—The City Council of Cooper, Delta County, is considering the proposition of putting in an electric light plant.

LAFAYETTE, IND.—The LaFayette Cracker Company will expend $30,000 in improving their plant. An electric plant will be installed.

DICKINSON, N. D.—Several parties are negotiating with the Dickinson authorities for the putting in of an electric light plant. The Northern Pacific is about to put in a plant here for use in its yards and machine shops, and there is some talk of organizing a home company to take power from the railroad and run the town plant.

ST. LOUIS, MO.—Plans are being prepared by J. H. Lynch, Imperial Building, for the Besthesada Hospital, to be erected on Vista street near Grand. The hospital will have an isolated electric plant.

New Incorporations.

CAMDEN, N. J.—The Electrical Construction and Maintenance Company of America—principal office, No. 421 Market street, Camden, N. J.—has been incorporated to manufacture electrical contrivances; capital, $100,000; incorporators, Charles S. Reber, William H. Stirling, Daniel S. Mishoe, all of Camden, N. J.

ST. LOUIS, MO.—The W. A. Fuller Electric Company has been incorporated; capital, $5,000; incorporators, W. A. Fuller, J. B. Carroll, G. W. Grant.

NEW YORK, N. Y.—The Perfect Arc Lamp and Manufacturing Company has been incorporated to manufacture electrical devices; capital, $100,000; incorporators, L. Sylvester, of New York city; C. Hagadorn, R. Ward, both of Brooklyn.

NEW YORK, N. Y.—The Chemical and Electrical Company has been incorporated, for the purpose of dealing in chemicals, cosmetics and electrical energy; capital subscribed, $2,000,000; paid in, $2,000,000, with the privilege of increasing the same to $5,000,000; incorporators, Albert E. Woolf, Calvin H. Allen, George W. Stockley, W. Scott Sims and L. B. Le Vake, all of New York city.

LYNDONVILLE, VT.—A new company, known as the Canadian Carbonate Company, of Lyndonville—capital stock, $25,000—has applied to the Secretary of State for a certificate of incorporation.

Increase of Capital.

ROCKWELL CITY, IOWA—The Central Telephone Company has increased its capital stock from $10,000 to $25,000.

MANHEIM, PA.—The Manheim Electric Light, Heat and Power Company will increase its capital stock to $60,000, for the purpose of purchasing the Mount Joy line.

Encouragement From the Old.

"Yes, sir; that's what I've come to see you for. I want to marry your daughter, Mr. Birckus. I'm a poor young man, but I'm one of these fellows that are willing to work without asking any questions. I can carry a message to Garcia."

"I am glad to hear it, young man. Suppose you start with it now."—*From the Chicago Tribune.*

Kindred.... ...Interests

The Western Electric Company, Chicago, has just issued a bulletin on wire guards for incandescent lamps. Several varieties are illustrated and described, and the bulletin may be had free for the asking.

The Electric Appliance Company, Chicago, who have made so many "scoops" in the electrical business, are enthusiastic over their latest, the Gutmann recording wattmeter for alternating-current work.

The Milwaukee office of the Martin J. Insull Company, the western selling agents of the General Incandescent Arc Light Company, New York, has been moved from Pabst Building to 408 Uihlein Building.

The Westinghouse Electric and Manufacturing Company, Pittsburgh, has produced a new and handsome catalogue of its electric railway motors, giving full details of these machines and also of the engine-type generators for railway work.

Attica, Indiana, is to have a new telephone exchange plant, the apparatus selected being of the Sterling Electric Company's make, 300 numbers of switchboard, distributing board and combined terminals and protectors being the initial order.

The Sterling Electric Company, Chicago, report having secured a contract with the Century Construction Company, of Cleveland, Ohio, for a 400-number equipment, including switchboard, distributing board and combined terminals and protectors.

The Westinghouse Air Brake Company, Pittsburgh, has brought out a sumptuous catalogue of the new electro-pneumatic system for controlling heavy railway and other motors which it has brought out in conjunction with the Westinghouse Electric and Manufacturing Company. This method is worked out to great completion and includes the pneumatic control of motors and brakes.

The plant of the Bullock Electric Manufacturing Company at Norwood, near Cincinnati, Ohio, is now fully equipped with the newest machinery, and is one of the most modern and interesting manufacturing establishments in the electrical industry. The company is reported to be extremely busy with a full complement of men working three nights weekly until nine o'clock. It is receiving many orders for printing press motors, to the designing of which it has given much attention; also the type "H" machines, which are its standard generators and motors, and the type "N" machines, which are adapted for machine tools.

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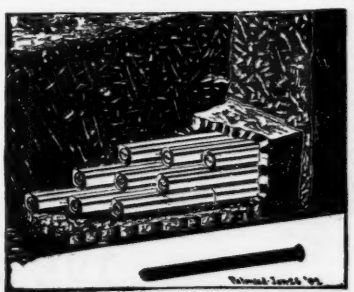
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Electrical.... Patents.

[Specially reported for this journal by E. G Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED OCTOBER 31, 1899.

635,815 System and apparatus for controlling electric vehicles; E. A. Sperry, Cleveland, Ohio—A dynamo-electric machine used to generate currents periodically, a controller for the circuits of such machine, a set of contacts on the controller connected with the field-coil of the machine, and an electric battery also connected to such last-named set for fixing the residual magnetism of the field of the machine, before starting upon the generating periods.

635,816 System and apparatus for controlling vehicles; E. A. Sperry—A source of electrical supply, a motor, a stopping-and-starting switch, an independent circuit-adjusting, current-graduating device, separate manipulators for the switch and the device, the switch and the device being in series-circuit relation.

635,819 Electric arc lamp; H. O. Swoboda, New York, N. Y.—Consists of the supporting-frame, the feed-magnet and a horizontally-disposed spring plate from which said magnet is suspended.

635,820 Telegraphic block-signal system; W. C. Taber, North Collins, N. Y.

635,851 Electric arc lamp; C. E. Harthan, Lynn, Mass.

635,852 Coin controlled telephone-call apparatus; G. B. Heath, San Francisco, Cal.—A coin-chute in sections with the sections separated horizontally and insulated from each other by an insulating-block supporting the lower sections, said sections being connected with the main lines and a lamp and key in circuit with the main lines.

635,862 Electric arc lamp; E. S. Lea, Elwood, Ind.

635,880 Summation meter; E. Thomson, Swampscott, Mass.—Consists of a number of recording devices independently effecting desired registrations, a separate motor device controlled by each register, a summation-register for all of the motors, and gearing between the motors and the register such that each motor actuates the summation-register to record the movement of its own controlling device independently of the other motors.

635,881 Electric meter; E. Thomson, Swampscott, Mass.—A motive device, means controlled by centrifugal force for governing said motive device, and means balancing said centrifugal force by the force exerted between relatively-movable coils in multiple with each other.

635,910 Electrical device; W. S. Boult, London, Eng.

635,930 Electric cigar lighter; F. H. Harriman, Hartford, Ct.

635,941 Safety attachment for propelled vehicles; J. P. Muller, New York.

635,944 Combined telephone and push-button; B. F. Smith, Bay City, Mich.

635,960 Conductor and cable terminal; H. G. Grush, Boston, Mass.

636,021 Device for operating electrically-illuminated signs; W. T. Bell, Nottingham, England.

636,023 System of control for electric motors; J. R. Cravath, Chicago, Ill.—The method of preventing the racing of electric motors, which consists in decreasing the torque of any motor whose counter electromotive force rises above the average counter electro-motive force of the motors of the set, and allowing said torque to remain at the value normally due to the current actually flowing, on any change of counter electromotive force of the motors as a set.

636,028 Electric system for automatically governing polyphase-circuit breakers; A. H. Engstrom, Philadelphia, Pa.

636,029 Automatic circuit breaking device for polyphase currents; A. H. Engstrom, Philadelphia, Pa.

636,030 Circuit-breaker; E. H. Engstrom, Philadelphia, Pa.

636,056 636,057 Electric-lighting gas-burners; R. C. Nourse, Boston, Mass.

636,069 Electric-bell; D. Rousseau, New York, N. Y.

636,087 Electric motor for fans; G. A. Tower, Richmond, Va.—A vertical support, a stationary filed-magnet attached thereto and having its upper side recessed to form an oil-cup around said support, said support extending downward into the oil-cup, an armature-carrier carrying an armature and a tubular shaft, this shaft embracing said central support and extending down into the oil-cup.

636,093 Electromedical apparatus; M. L. Whitfield, Memphis, Tenn.

636,097 Electrical measuring instrument; Victoria Arcioni, Ivres, Italy.

636,116 Automatic relay; F. E. Chapman, Medford, Mass.

636,134 Telephone-call register; W. Gray, Hartford, Ct.

636,139 Fire-alarm signal-circuit; W. R. Hewitt, San Francisco, Cal.

636,142 Secondary battery; A. E. Hodgson, Halifax, England—A separator for the plates of secondary batteries formed of glass fibers woven into a flexible fabric and secured at the edges thereof.

636,182 Electrical measuring instrument; F. W. Roller, New York, N. Y.

636,203 Electric resistance; Hugo Helderger, Thalkirchen, Germany—An electric resistance consisting of a non-conducting backing or supporting plate, and a facing metallic foil impressed upon or into the supporting plate.

636,209 Telephonograph; J. E. O. Kumberg, London, Eng.

636,212 Electrodepositing cell; M. Perreur-Lloyd, London, Eng.—An anode and a rotary cathode, a normal animal skin or membrane arranged in light contact with the rotary cathode and freed from all matters which can become soluble or adhesive at or below 60 degrees Fahrenheit.

636,229 Means for placing, removing and cleaning electric lamps; E. E. Simms, Albert Lea, Minn.

TRADE NOTES.

The Falcon Electric Manufacturing Company, 432-436 East Seventy-first street, New York, has just issued bulletin No. 1 of "Falcon all-drawn pure copper knife switches," of which it is the manufacturer.

The "Youth's Companion" calendar for 1900 is unique in form and beautiful in design. The oval centre-piece, in high colors and enclosed in a border of flowers, represents "A Dream of Summer," and is supported on either side by an admirably executed figure-piece in delicate tints. The whole is delightful in sentiment and in general effect. Larger than any of the *Companion's* previous calendars, it is equally acceptable as a work of art. As an ornament to the home it will take a preeminent place. The calendar is published exclusively by the *Companion,* Boston. It can not be obtained elsewhere. It will be given to all new subscribers for 1900, who will also receive, in addition to the fifty-two issues of the new volume, all the issues for the remaining weeks of 1899, free from the time of subscription. Illustrated announcement number, containing a full prospectus of the volume for 1900, will be sent free to any address.

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